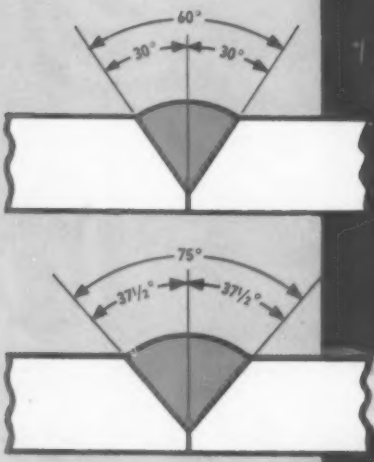
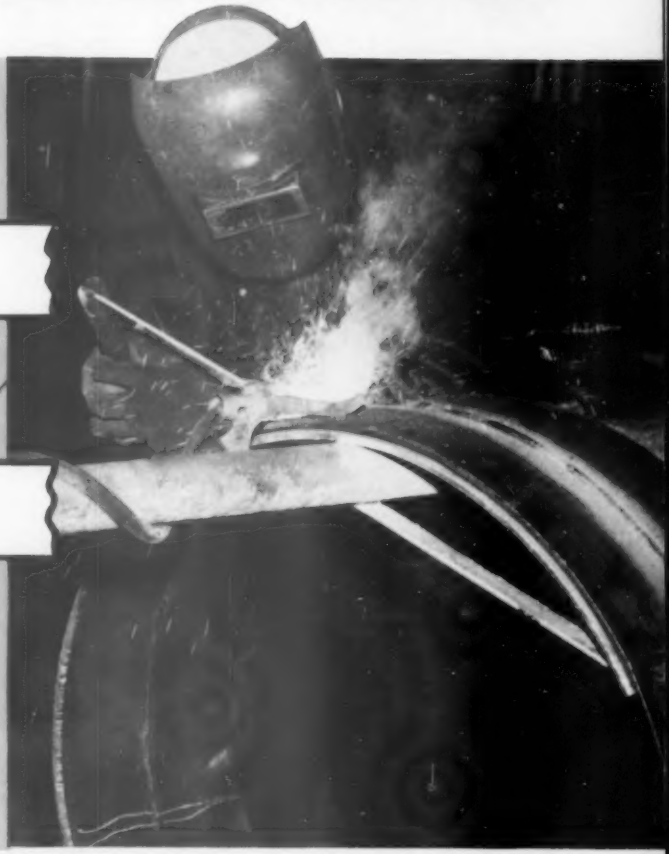
NOVEMBER, 1955

INDUSTRY & WELDING



WHICH PIPE WELDING BEVEL?

A series of tests was made to see if the 37½° bevel or the 30° bevel was more efficient. See Page 62 for results.



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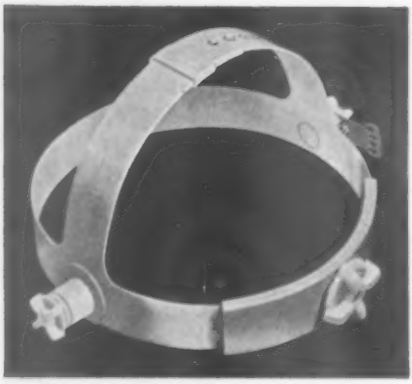

NEW All Nylon Adjust-O-Lok Headgear

Nylon, lightweight and non-conductive, lends its superior, long wearing strength to every part of this completely redesigned arc welding helmet headgear.

The large, easy to handle winged knob and the gear, both of Nylon, engage a Nylon headband to give fine adjustment to head size while helmet is worn. Headband is molded in one piece with a cross strap, *now also adjustable*, over the top of the head.

The headband adjustment is entirely enclosed in a Geon sleeve, smooth fitting against the head.

Jackson Leads Way with Better Helmets

NEW Nylon Friction Pivots

All pivot parts are Nylon, except the entirely enclosed spring, so no current can pass through to the wearer's head. New winged nuts provide easier hand adjustment from the outside without taking the helmet off. A stop, located inside of the helmet shell, is attached to one of the Nylon pivots to halt the helmet's down movement, and is quickly adjusted to the exact position you may require.

NEW Straight Front Helmets with Fiber Glass Shells

To those who prefer helmets of this popular shape, JACKSON now offers a line of helmets of the same quality as its curved and narrow shell styles, with the same new features. Made of fiber glass, strong, smooth, easy to clean, resistant to heat and moisture, *they last.*

For the Best in Arc Welding Helmets Jackson Offers You 3 x 3 x 2 = 18 Models to Choose from

YOUR CHOICE OF:

3	HELMET SHELLS...	CURVED SHELL	NARROW SHELL	STRAIGHT SHELL
3	LENS HOLDERS...	PLASTIC FIXED FRONT	METAL FIXED FRONT	PLASTIC LIFT FRONT
2	HEADGEARS...	THE NEW ALL-NYLON ADJUST-O-LOK — OR THE ECONOMY HEADGEAR No. 62		

All Lens Holders and Headgears are Interchangeable

Made by the World's Largest Manufacturer of Arc Welding Electrode Holders, Ground Clamps and Cable Fittings, Sold World-Wide through Distributors and Dealers.

JACKSON
PRODUCTS, INC.
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. . . you get better welding faster with

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200 to 600 amp. Electric Drives

Check these "extra quality" exclusive features that CUT WELDING COSTS!

1. All arc welded steel frame
2. Convenient cable connectors
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5. Bi-directional ammeter
6. Bi-directional voltmeter
7. Convenient start and stop buttons
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10. Optional equipment: Choice of portable mountings—meters

Top performance and low cost are Hobart bywords that mean you get extra years of dependable service with low maintenance cost—at NO extra charge.

Hobart's liberal use of copper, two-way ventilation, greater arc stability, safer, more efficient operating temperatures, make Hobart today's best welder value.

Choose a Hobart—you'll find it's the one welder that gives you superior performance with day-in, day-out economy of operation. Write today for full information on the welder of your choice!

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200 to 600 amp. Gas Drives

AC Transformer

200 amp. "Husky Boy"

200 amp. AC-AC

You'll like these smooth welding Hobart electrodes

A simple comparison will prove Hobart's superior, top quality welding—in every application. You'll be surprised at the real difference in Welding Electrodes. Get the extra speed that means lower production costs—Try Hobart.

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☐ Electric Drive ☐ Gas Drive
☐ Transformer ☐ "Husky Boy" ☐ 200 amp. AC-AC

Our work is _____

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Effects "DOUBLE" Protection!

"SPEEDY"

No. 5000 ATTACHMENT

THIS INGENIOUSLY DESIGNED, *yet simple to use,* "SPEEDY" Attachment adapts the welding helmet for use with a Safety Cap to provide *both* eye and head protection for the Welder when he works under conditions where there is danger of head injury from falling or flying objects.

"SPEEDY" is economical both as to cost and in speed of attachment . . . or detachment! It represents very practically FIBRE-METAL's long experience and ability to provide the best possible *products for protection* that also help make the most profitable use of a man's time.

The No. 5000 "SPEEDY" Attachment consists of two rugged steel Clips with insulated prongs to grip the edge of the Safety Cap; a sturdy, replaceable Neoprene Strap connecting the Clips and providing tension over the top of the Cap. Friction joints hinge helmet on cap. Write for Bulletin No. 43.

No. 5000 "SPEEDY" FEATURES:

- LONG LIFE: ECONOMICAL, PRACTICAL
- SPEEDY ON OR OFF
- FITS ALL POPULAR PEAK-TYPE CAPS
- NO HOLES IN CAP
- NO HARDWARE ON CAP
- CONTINUOUS HEAD PROTECTION
- ADAPTS PRESENT HELMETS TO COMBINATIONS

When buying any protective equipment . . . always ask for a FIBRE-METAL *product!*

FIBRE-METAL

Circle No. 3 on Reader Service Card.

CITY

Industry & Welding

NOVEMBER, 1955

VOL. 28 NO. 11

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BPA

MEMBER
American Welding Society
National Welding Supply Association
International Acetylene Association

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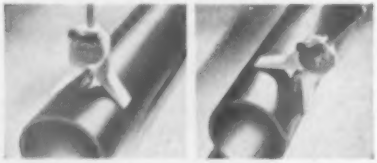
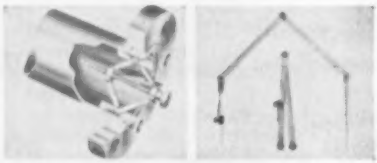
LAYOUT PIPE JOINTS (Ys, Ts, Ls or any angle joint) in minutes with the Contour Marker on any size pipe from 1½" to 48". Absolutely accurate. Two sizes: Standard for 1½" to 18" pipe; Jumbo for 16" to 48" pipe.



MARK A CENTER LINE at any angle on a pipe, with Boyce Centering Head. Leveling gauge on dial protractor establishes angle; hardened punch marks it.



ALIGN PIPE AND FLANGE (slip on, lap joint, stub-end & welding neck) with this expanding tool.

MARK ANY ARC or circle up to 48" with this folding, all metal 24" Radius Marker.

CONTOUR MARKER CORP.
of California

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SOLD BY WELDING SUPPLY DEALERS

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INDUSTRY & WELDING

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SINCE 1918

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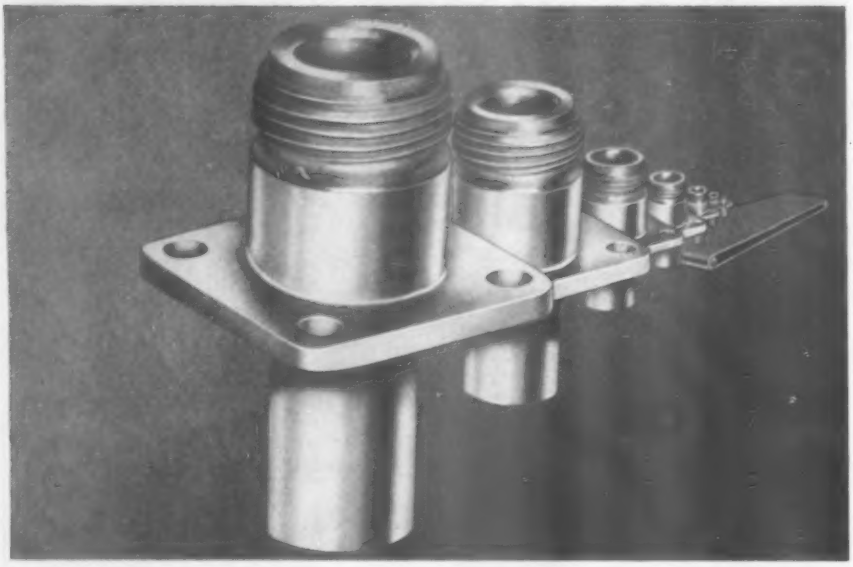
Joining Metals?

Then **BRAZE** *Them For* SPEED



With L.T. PHOSON & SILBOND*

There are more profitable uses for the time you spend joining metals with old fashioned fasteners! L. T.* brazing saves this time . . . gives it back to you as a "bonus"!

Compare L. T.* brazing time costs with fastening time costs. Or, better still, let us give you brazing time cost comparisons on *your* job through sample lot brazing!

In addition to speed, consider that Phoson and SilBond Brazed Joints give you high electrical and thermal conductivity, excellent resistance to corrosion . . . and equally important in this age of automation, they lend themselves to mass production methods.

L. T.* braze for speed . . . and for strength . . . and for liquid and gas *pressure-tightness.*

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*Low Temperature

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Brazing Alloy Division • Providence 7, R. I.
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Permanently United

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POWER-BUILT TO LAST!

This Black & Decker 7″ Standard Sander typifies the power, speed and accuracy of all B&D tools. It has 20% more power to handle your toughest sanding jobs—20% less weight to greatly reduce operator fatigue—spiral bevel gears to provide continuous, smooth power! These outstanding features coupled with its ability to sand, grind and wire brush, much faster and easier, make the 7″ Sander indispensable to your work! For more information, write: THE BLACK & DECKER MFG. CO., Dept. 7611, Towson 4, Maryland.

Drills • Grinders • Hammers • Shears • Vacuum Cleaners • Black & Decker makes a complete line of portable electric tools.

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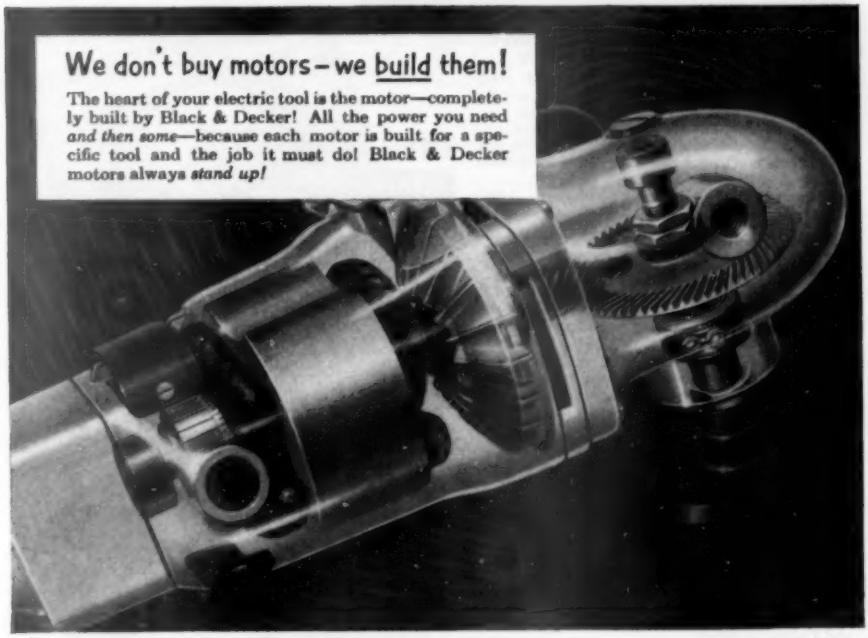
PORTABLE ELECTRIC TOOLS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The heart of your electric tool is the motor—completely built by Black & Decker! All the power you need *and then some*—because each motor is built for a specific tool and the job it must do! Black & Decker motors always *stand up!*

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ACCO products

3 Big Reasons for Buying PAGE Automatic Welding Wire

1. PACKAGED TO FIT YOUR PARTICULAR REQUIREMENTS
2. A WIDE RANGE OF ANALYSES TO FIT A PARTICULAR JOB
3. GREATEST CONVENIENCE—YOU CAN BUY FROM LOCAL STOCKS

PAGE packages its great line of welding wires in a variety of ways for utmost protection and convenience in handling, stocking and using.

Some of these packaging methods are shown at the left...There are lightweight, durable Leverpaks which give protection against coil distortion or wire corrosion. Easily opened and resealed, they roll easily and stack perfectly. They take a minimum of floor space.

There are single and pallet-mounted (1,000 lb., 2,000 lb., 3,000 lb.) coils, each wrapped in waterproofed paper and held secure by steel strapping; thread-wound, 25-pound reels to fit popular machines; also, coils in individual cardboard cartons, available singly or palletized for handling by fork-lift truck.

PAGE offers exactly the Right Analysis —26 in all—for every Welding Job . . .

No matter how "special" or "different" your welding-wire requirements may be, they can be met by one of the *26 different analyses* in the PAGE line.

These "cover the waterfront" of applications: heavy automatic submerged arc...light manual submerged arc...inert gas manual and automatic, tungsten or metal arc.

Carbon Steel • Any carbon from Armco (.025 max.) to high carbon (.90—1.10)

Low Alloys • All the most popular welding grades

Stainless • All standard AISI grades. Other types on request.

The Right Electrodes, Rods, Spray Wire

Your welding job deserves the *right* electrodes and the *right* rods—and you can get them from the wide range offered by PAGE!

Gas Welding Rods • Armco, mild steel, low alloy, 3½% nickel, carbon or stainless steel, manganese or naval bronze

Bare Electrodes • Any carbon from Armco to high (.90—1.10) carbon

Metal Spray Wire • Any carbon from Armco to 1.00 carbon; also 3½% nickel, manganese or naval bronze, and stainless steel

Convenient Service from Local Stocks

Wherever you live, your nearby PAGE Distributor can fill your needs quickly and easily. This handy service saves time for you, and lets you keep your inventory investment at a minimum. Your PAGE Distributor thus makes double savings for you—a saving in time and a saving in dollars.

ACCO

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

Better Value

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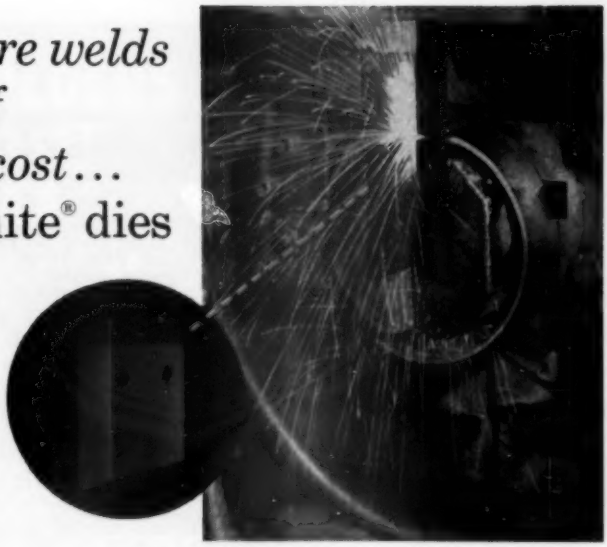
4 *times more welds ...at half the cost...* with Elkonite® dies



Die insert for this flash and butt welding machine is faced with Elkonite 10W55 . . . a dense, hard material with high resistance to arc erosion, high strength and good electrical conductivity. The backing material is Mallory 53 alloy.

On the flash butt welding of transmission brake bands, a large manufacturer of automatic transmissions has made real improvements in the economy and volume of production . . . by the use of Mallory engineered die inserts faced with Elkonite alloy. Here are the actual production results:

Electrode life quadrupled. Elkonite-faced inserts produce over 32,000 welds . . . in contrast to 8000 with the previous type of dies.

Down time reduced 75%. Longer runs between dressing cut machine down time . . . helps in maintaining high production rates.

Lower cost per weld. Cost of die insert material per weld is *less than half* what it used to be.

You can find a cost-saving, production-boosting solution to your own resistance welding problems by calling on Mallory. An unequalled variety of electrodes in scores of shapes and sizes are available . . . with the exclusive Mallory fluted cooling hole or standard round hole. You can count on Mallory, too, for electrode holders, seam welding wheels, castings, forgings and dies. The selection of standard designs covers most of the welding work you will encounter. For special requirements, your nearby Mallory welding distributor will be glad to aid in your selection . . . or our staff of welding specialists will give your problem the benefit of our years of experience in the welding field.

For the latest technical data on the Mallory line, write to us for a copy of the Mallory Resistance Welding Catalog.

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

Circle No. 9 on Reader Service Card.

NEW REFERENCE DATA

The publications featured on these pages were written by experts. They are FREE to our readers. To obtain these helpful reference materials use postcard bound into this issue.

"STEEL BUYERS' GUIDE" is the function of Bulletin 11-2 issued by Joseph T. Ryerson & Son, Inc. The bulletin gives quick information on standard steel specifications; type, range and accuracy of cutting to users' needs and how money can be saved by combining orders. Hot rolled carbon bar, structural and flat rolled steel are featured. **Circle No. 100.**

NEW DEVELOPMENT: A MAGNETIC CENTERING DEVICE FOR CIRCULAR FLAME CUTTING, is described in the latest bulletin issued by Tradeware Corp. The new descriptive folder shows how it is now possible to machine flame cut metals without marring the central area of the plate. More uniform cutting can be done because operator does not have to hold the device in position. Set-ups are said to be simpler and quicker. **Circle 101.**

HOW TO SIMPLIFY CAST IRON WELDING is explained in bulletin 109 B, now available from The International Nickel Company, Inc. The Company describes several of their recommended rods, and illustrates a number of successful applications. A complete range of sizes is included. **Circle No. 25 on Reader Service Card.**

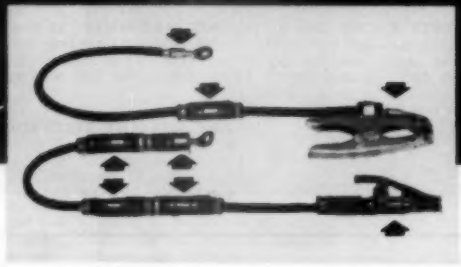
MANGANESE-NICKEL STEEL ELECTRODES are thoroughly described by the manufacturer, the Taylor-Wharton Iron and Steel Co., in brochure No. 451. The brochure describes the need which industry has for electrodes of this type, and also gives physical properties and describes methods of applying this rod teeth. A worth while addition to the shop note book. **Circle 80.**

TUBE AND PIPE NOTCHING TOOLS AND CUT-OFF MACHINES are described in an interesting folder put out by the Vogel Tool & Die Corp. These tools may be used with a hand press, which the company is able to supply, or they may be used with a power punch press of standard design. It is claimed that the notching tools will make perfect joints for welding or brazing, cutting clean edges and thus eliminating the need for further finishing. Design details, press specifications, and prices are given. **Circle No. 102 on Reader Service Card.**

FAR-INFRA-RED SOLDERING OVENS and how they can give faster, better soldering is explained in technical literature from Electric Industries Div. of Amperex Electronic Corp. Complete operating instructions and mechanical specifications are given for the Livingstone soldering oven whch features fast warm-up, uniform heat distribution and 5-speed conveyor belt. **Circle 103.**

LATEST ROTATING GROUND ATTACHMENT said to meet the need for trouble-free, safe transfer of welding current to rotating work is described in a loose-leaf bulletin, No. 11-54, of the Wagner Manufacturing Co., Inc. Models ranging from 500 amperes up to 1500 amps are shown. Several applications are shown, and detailed drawings of the various parts which make up the ground attachment are included, along with price data. **Circle No. 104.**

YOUR HOLDERS ARE OBSOLETE IF... they're not CADDY®



A CADWELD®-CADDY Arc Welding CIRCUIT makes mechanical connections obsolete.

Welders all over the country agree — CADDY Holders are BEST

They're COOLER—Because the CADDY Holder was designed for the CADWELD CONNECTION, giving you a 100% efficient electrical circuit — no hot spot mechanical connection.

They're LIGHTER—Because the heavy cast body is gone — replaced by a lightweight non-current carrying steel stamped body.

TRY CADDY today—you too will see the results—

1. **Satisfied Welders**
2. **Greater Production**
3. **Less Maintenance**
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CADDY® Arc Welding Accessory Div.

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Circle No. 10 on Reader Service Card.

GET A GRIP ON THINGS . . . PARTICULARLY IRON AND STEEL, with a new permanent magnet holder featured in the latest brochure No. 53 issued by the manufacturer, James Neill & Company Ltd. The brochure shows actual applications for holding work to be welded. Description, photos and drawings show that it is as useful as an extra pair of hands. **Circle No. 46.**

BRONZE WELDING RODS designed to meet various Federal, Navy, ASTM and AWS specifications are described in a new Bridgeport Brass Company bulletin. Along with the detailed specifications of five different rods—Low Fuming Manganese Bronze, Bridgeport Bronze, Silicon Bronze, Nickel-Silver, Manganese Bronze (Navy)—a very useful shop chart is included showing melting points, melting point ranges, and the color scale of many different metals at a range of temperatures. **Circle No. 105 on Reader Service Card.**

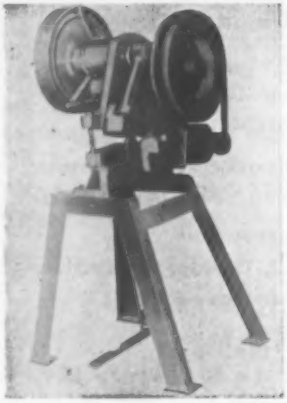
WELDING AND CUTTING TORCHES AND EQUIPMENT are featured in Smith Welding Equipment Corporation's latest complete catalog, No. 355. Like the mail order catalog, it is profusely illustrated. Advantages and applications are explained. Prices are included. **Circle No. 106 on Reader Service Card.**

"SAFETY GUIDE FOR GRINDING MACHINES" is the title of a simple and concise 4-page pamphlet issued by Safety Committee of Grinding Wheel Institute. The publication lists 20 simple safety precautions to be taken when operating a grinding machine. These are broken down into "Do and Don't" form. **Circle No. 107 on Reader Service Card.**

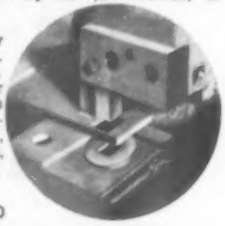
ARC WELDING ELECTRODE HOLDER, claimed by its manufacturer, Bernard Welding Equipment Co., to be of the most modern design—cool and comfortable to handle, and many patented features—is described in convenient pocket sized booklet SS-3. **Circle No. 108 on Reader Service Card.**

BATEMAN POWER SHEAR

IDEAL FOR THE USERS OF SMALL ANGLES OR FLATS



- **No grinding necessary after cut.**
- **Cuts angles up to 2" x 2" x ¼" and flats up to ¼" x 4".**
- **Flywheel with a gear drive for power with a small motor.**
- **A one stroke cycle clutch operated by either hand or foot.**
- **With clutch open, will make 44 strokes per minute.**
- **Made of high grade cast iron, hardened clutch and clutch pin, shear steel blades.**
- **From floor to top of machine—56" with stand. Floor to shear blade—36". Floor space required—24" x 27".**
- **With notched blade—will cut up to ¾" rounds, or ⅝" reinforcing rod.**
- **Special blade and punch for ornamental iron work.** ¾ HP. motor required for power. We furnish 2-groove motor pulley and 2 belts when ordered without motor. Shipping wt. approx. 485 lbs., without stand. With stand, 560 lbs.



WITH MOTOR AND STAND $450.00

BATEMAN FOUNDRY and MACHINE CO. • Mineral Wells, Texas

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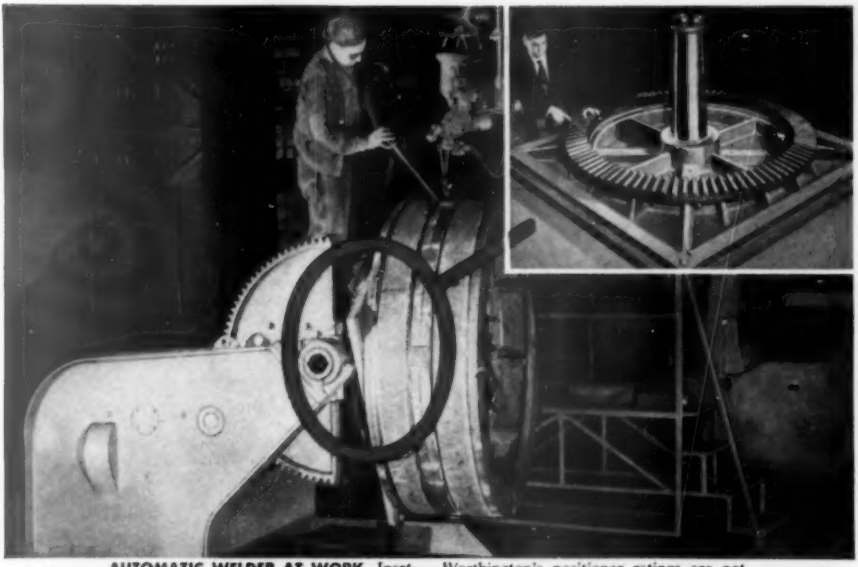

AUTOMATIC WELDER AT WORK. Inset shows extra-large spindle and rugged bull gear of Worthington Welding Positioner, rated at 24,000 pounds, continuous duty

Worthington's positioner ratings are not just a by-product of the design. Rather, they are the result of extensive tests in laboratory and field

Double-check welding positioner ratings!

FREE New Bulletin R-1700-B15 shows you how to choose a positioner. It answers the seven basic questions you should ask before you buy *any* positioning equipment.

— don't underestimate their importance

In positioners, as in all Worthington products, ratings result from extensive tests in the laboratory and on the job.

Here are two steps that we take to assure you that every Worthington positioner rating is a *job* rating:

1. Each model is proved on the job before marketing as a standard unit.
2. Each positioner part, including motors, gears, and bearings, is selected to give you extra capacity for overload conditions.

Extra capacity, honestly rated, is typical of *all* Worthington Positioners — from smallest to largest, rated up to 50 tons.

No matter what your size requirements, there's a Worthington Welding Positioner for your job. Like all other Worthington products, its rating is backed by the integrity and reputation of 114 years of engineering experience. That's why you can rate our ratings as "conservative." Write for new Bulletin. Worthington Corporation, Harrison, New Jersey. Y59

WORTHINGTON

Welding Positioners • Turning Rolls

Circle No. 12 on Reader Service Card.

STEEL LIFTING CLAMPS which increase their gripping power as the load becomes greater, are described in a 16-page loose-leaf cataolg issued by J. C. Renfroe & Sons, Inc., the manufacturer. Designed for both light and heavy lifting—from 1 to 20 tons—they are said to be made of the finest grade tool steel and feature a safety snap lock. Specifications include, lifting capacity, jaw opening, weight, and dimensions. The parts are each identified on a separate sheet. **Circle No. 109 on Reader Service Card.**

36-PAGES ON THE WORKING AND FABRICATING OF STAINLESS TUBING AND PIPE is offered by Alloy Tube Div., Carpenter Steel Co. Each of 11 different types of fabrication is illustrated and described with design hints and valuable tabular data supplied. **Circle No. 110 on Reader Service Card.**

200-AMP ENGINE-DRIVEN WELDER is announced by the General Electric Company in their new bulletin GEC-1333. Among the features mentioned are smooth, slow running Hercules which will keep the welding machine in action 13 hours at full-load rating on tankful of gas; NEMA rated; superior arc characteristics; and a slowdown control which saves on gas and oil and reduces wear. **Circle No. 31 on Reader Service Card.**

BRAZING ALLOYS AND SOLDERS FOR BONDING ALUMINUM AND ITS ALLOYS are the subject of a new "how to use it" booklet prepared by All-State Welding Alloys Co., Inc. Data is thoroughly and effectively presented. **Circle No. 112.**

46 INDIVIDUAL TYPES OF AUTOMATIC WELDERS for submerged, inert arc and resistance welding are featured and illustrated in a new, 54-page spiral-bound, 8½ by 11-inch comprehensive catalog available from Expert Welding Machine Co. The company's complete line of machines, automation machines and special machine tools is described in detail. **Circle No. 113.**

FIRST TRULY PORTABLE
200 AMP. ARC WELDER

Weighs only 65 lbs.; carry it to the job!
Using the first TOROIDAL transformer!

BREN-WELD MODEL 200 AW

OBSOLETES ALL OTHER WELDERS OF COMPARABLE RATING!

Employing the first toroidal transformer ever used in arc welders, the portable Bren-Weld does the work of conventional welders 4 to 5 times its size and weight. Eliminates the necessity to transport bulky equipment or heavy parts to be welded.

Bren-Weld handles electrodes from 3/64" through 5/32"; it has adjustable arc voltage for various arc characteristics.

Because it is so flexible in operation and application, Bren-Weld is ideal for plant production and maintenance, for construction work, for railroads, on the farm and in home workshop.

- 200 Amp.—At 50% Duty Cycle
- 250 Amp.—Reduced Duty Cycle
- 110/220 Volts A.C., 50/60 Cycles
- *Also Available For 220/440 Volts*
- Fully Guaranteed

11" x 12" x 7½" LIST PRICE F.O.B., L. I. City **$169.50**

Lowest Price On Market For Comparable Ampere Rating

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FREE! For details of free trial offer and folder see your dealer or write directly.

Manufactured by BRENNEN, BUCCI & WEBER, INC. New York City

Sales Division
KASSON DIE & MOTOR CORPORATION
INTEGRITY SINCE 1919
32-14 Northern Boulevard, L. I. City I, N.Y.

A KASSON PRODUCT

Circle No. 13 on Reader Service Card.

More grinding . . . done faster. That's the story of Simonds Abrasive high speed resinoid bonded grinding wheels . . . for grinding welds, removing flash and bead, cleaning up rough ragged surfaces. Especially efficient for rough snagging and high speed cutting on brass, copper, aluminum and stainless steel.

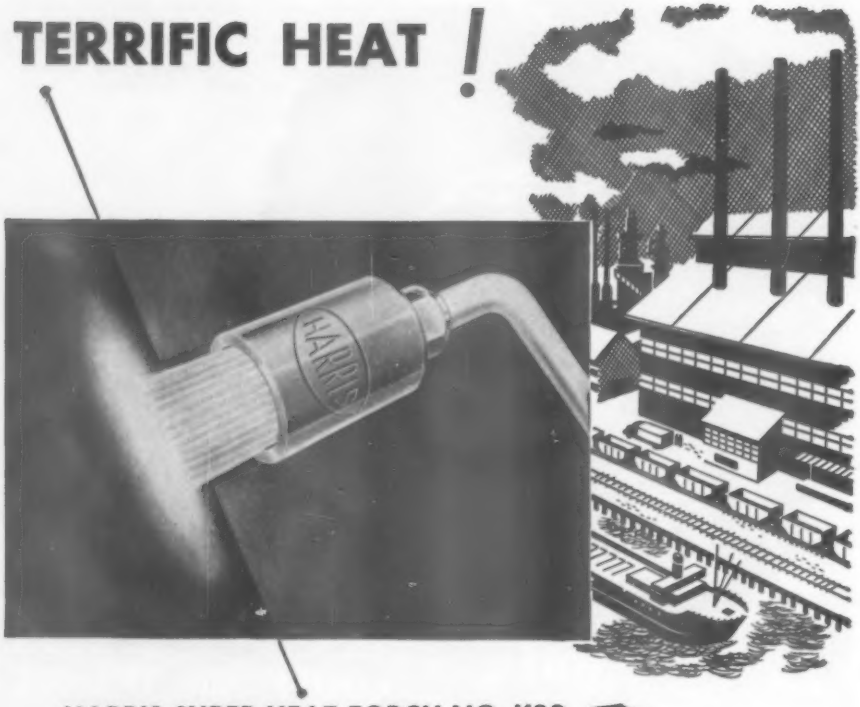
Call your Simonds distributor to show you how these fast clean cutting wheels can save on your weld grinding costs.

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco • Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass. • Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Heller Tool Co., Newcomerstown, O., Simonds Canada Saw Co., Ltd., Montreal, Quebec, Lion Grinding Wheels Div., Brockville, Ont. and Simonds Canada Abrasive Co., Ltd. Arvida, Quebec

Circle No. 14 on Reader Service Card.

TERRIFIC HEAT !



HARRIS SUPER-HEAT TORCH NO. K23

Heat is the Prime Factor utilized in connection with Innumerable Metal Working Operations. While it is a fact that the Oxy-Acetylene Welding Torch is universal in its applications, there are many Operations requiring a much greater volume of Intense Heat than can be obtained from a Welding Torch.

A definite limitation exists relative to the amount of Oxygen and Acetylene Gases which can be safely mixed without danger of the Flame "Back-firing", due to the extremely fast Flame Propagation Characteristics of such Gas Mixtures. On the other hand, much larger volumes of such Fuel Gases as Propane, City Gas and Natural Gases can be safely mixed with Oxygen on account of their lower rate of Flame Propagation. It is evident the larger the volume of Gases mixed, the greater the Flame and resulting Heating Value. This produces the truly phenomenal results achieved by this Harris Super-Heating Torch.

The applications of this Harris Torch are unlimited, where large volumes of Intense Heat are required, either as a Portable or Stationary Unit. In places where Massive Shafts are to be Straightened; Large Size Pipe Bent; Flanging or Straightening of Steel Plates; Brazing Heavy Copper Pipe, etc., etc., this Harris Torch, with its **TERRIFIC HEAT**, is the answer.

HARRIS 50 1905 1955 ANNIVERSARY

SEND FOR DESCRIPTIVE FOLDER NO. 540710

THE HARRIS CALORIFIC CO.

CLEVELAND 2, OHIO

Circle No. 15 on Reader Service Card.

Now . . .

weld manganese bronze and yellow brasses without preheating —

with

AMPCO* MANG-TRODE

That's right — Ampco's revolutionary new manganese-bronze electrode can be applied when the piece is at room temperature. You needn't bother with costly pre-heating. Arc-welding with Mang-Trode is fast, because you can use high current densities. And you get dense, solid deposits that look good and that have mechanical properties similar to those of the base metal.

Mang-Trode cuts costs, speeds operations, on all manganese-bronze and yellow brass welding. Prove it to yourself. Order Mang-Trode now through your nearby Ampco distributor or write us.

*Reg. U. S. Pat. Off.

AMPCO METAL, INC.
Dept. IW-11
Milwaukee 46, Wisconsin
West Coast Plant • Burbank, California

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W-133

Circle No. 16 on Reader Service Card.

NEWS of the WELDING INDUSTRY

Netch Manages Sales of Vickers Welders

V. V. Netch has been named Manager of Welder Sales for Vickers Electric Division, Vickers Incorporated, a unit of Sperry Rand Corporation, St. Louis, Missouri.

Mr. Netch was formerly vice president of Hill Equipment Engineering Co. and has specialized in the welding field for the past 22 years.

C. M. "Mike" Burnett will continue in his present capacity as coordinator of dealer representatives.

Liquid Carbonic Opens West Coast CO_2 Plant

A $1,500,000 carbon dioxide plant has been opened in Oakland, California, by the Liquid Carbonic Corp. Plant has a capacity of from 50 to 60 tons of carbon dioxide daily, is the largest of its kind on the West Coast and is said to come as close to complete automation as any plant in the world today. Announcement was made by J. A. Graham, Jr.

G. E. Rectifier Department Builds New Plant

A General Electric Co. plant costing in excess of $5,000,000 will be built at Lynchburg, Va., as the new home for the Company's Rectifier Department, now located at Lynn, Mass., and at Limerick, Maine.

Max I. Alimansky, general manager of the department, announced that actual construction will start in March, 1956. Initial production is scheduled for January, 1957.

Miller Electric Mfg. Appoints Owings

Miller Electric Manufacturing Co., Inc., of Appleton, Wisconsin, recently appointed S. B. Owings to the position of Assistant Sales Manager. Appointment was nounced by Niels C. Miller, president of the company.

Mr. Owings has been active in the electric arc welding industry for some time and was formerly associated with National Cylinder Gas Company of Chicago, Illinois.

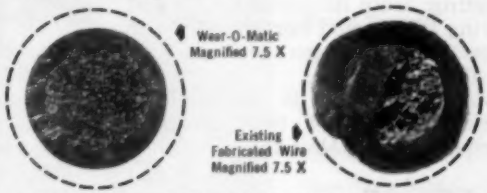
NEW...

Wear O Matic

Precision drawn fabricated wire for Automatic and Semi-Automatic Hard-Facing Applications

COMPARE

this major development in fabricated wire with existing wire . . .



These cross sectional views of fabricated wire were made under identical conditions. Notice the compactness and perfect roundness of Wear-O-Matic precision drawn wire as compared to existing fabricated wire. This dense, controlled diameter wire provides the smooth feeding and excellent arc characteristics of solid welding wire and insures a weld deposit that is uniform in soundness, chemistry and hardness.

Wear-O-Matic OFFERS THESE EXCLUSIVE FEATURES

1. Smooth, trouble-free feed with any automatic head—without special feed rolls or contact tubes.
2. Precision drawn for perfect roundness to insure continuous, smooth feeding.
3. Uniform compactness for uniform chemistry and hardness.
4. Electroplated with copper to prevent surface rust and insure positive electrical contact.

Make your own comparison . . .

Write for free sample specimen of new Wear-O-Matic wire—the only fabricated wire that's as easy to use as solid wire. Compare and prove to yourself why Wear-O-Matic is the wire you want now! Just write:

DRAWALLOY CORPORATION
Lincoln Highway at Alley Street
York 11, Pennsylvania

Drawalloy

CORPORATION
YORK, PENNSYLVANIA

Circle No. 17 on Reader Service Card.

Industry Mourns Passing of Mrs. E. C. Caluwaert

It was with very deep regret that the welding industry learned of the recent death of Mrs. E. C. Caluwaert, wife of E. C. Caluwaert, National Welding Supply Association president and head of O.K.I. Welding Supply Co., Cincinnati, Ohio.

"Bernie," as Mrs. Caluwaert was known, was admired by many members of the N.W.S.A. and the welding industry in general. She and Eddie have attended N.W.S.A. meetings from its earliest days and during this period her friendly and cheerful disposition endeared to all she met.

Mrs. Caluwaert is survived by her husband and two children, Bernadine and Michael.

Seal-Seat Company Moves

Seal-Seat Company has moved to new and larger quarters at 2326 Sawtelle Blvd., Los Angeles, Calif., it was announced by George M. Acker, sales manager. Expanded area and facilities are now available to enlarge the company's line of seals, diaphragms, gaskets and replacement parts.

EDITOR'S NOTE

Because several lines were misplaced in the article, "Your Stainless Welds—Are They Corrosion-Resistant? Leak - Tight?," (September INDUSTRY & WELDING) the entire article has been reprinted in correct form.

Copies of the 4-page reprint can be had by writing to A. Grodner, Alloy Fabricators Div., Continental Copper & Steel Industries, Inc., 345 Madison Ave., New York 17, N. Y.

Davies of M.S.A. Heads Safety Group

John B. Davies, manager of industrial sales, Mine Safety Appliances Co., Pittsburgh, was elected president of the Industrial Safety Equipment Association at the group's recent annual meeting.

A graduate of Carnegie Institute of Technology, Mr. Davies joined Mine Safety as a chemist in 1919, five years after the company was founded. Before assuming his present position, he was assistant sales manager.

Mr. Davies is a member and officer of several industrial safety organizations.

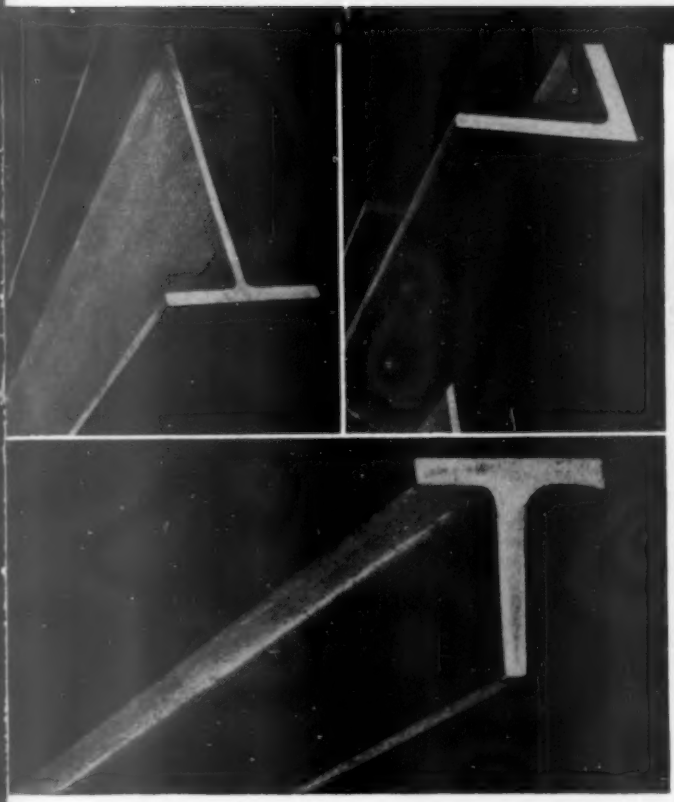
Industriline, Inc. Is New Electrical Firm

Formation of a new corporation, Industriline, Inc., which will offer new water-proof and shock-proof cable connectors, strip heaters for preheating and new types of electrode holders was recently announced.

The new company was formed by principals of Empire Products, Inc., Cincinnati, Ohio, and J. B. Nottingham & Co., Inc., New York City. Officers of the new company are J. B. Nottingham, president; Robert Senior, vice president, and Paul Savoca, secretary. General offices of the new firm are at 441 Lexington Ave., New York City. Factory is located in Cincinnati.

(More News on Page 115)

Circle No. 18 on Reader Service Card. →



Call U.S. STEEL SUPPLY for ALL your steel needs...

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- Reinforcing Bars, Wire Fabric
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Give us a call...we've got 'em all!

IF YOU NEED SHAPES, call U.S. Steel Supply.

Whatever you want, we've got . . . ready to be delivered to you fast!

Our selection of ASTM-A7 structural shapes is complete, including junior beams. And when you get them, they're *right*. Our friction saw cutting results in a smooth accurate cut. Your steel arrives on the job in prime condition, ready to use.

We can supply all supplemental items, too . . . such as high strength bolts and Dardelet rivet bolts.

So call us *first* for structural shapes. Be sure of getting *what* you want, *when* you want it, and *where* you want it . . . in a hurry!

FREE—VALUABLE LITERATURE

This complete, 71-page book, "Hot Rolled Carbon Steel Structural Shapes" contains complete data on the shapes we carry—including nominal dimensions, weights, properties and dimensions for detailing. Features many diagrams and ready-reference indexing.

Also available are two other books: 1) USS COR-TEN Steel—the complete, fully illustrated story on this important high strength steel. 2) Our big, new U.S. Steel Supply Stock List.

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- ☐ Structural Shapes
- ☐ USS COR-TEN High Strength Steel
- ☐ U.S. Steel Supply Stock List

Name.....

Company.....

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City.....State.....

Manual for Brazing

The Committee on Brazing and Soldering of the American Welding Society has prepared a book on brazing which gives valuable information on seven different types of brazing. Called "Brazing Manual," the 193-page book gives step-by-step instructions on brazing of every conceivable metal of industrial importance. An invaluable appendix in convenient chart form lists properties of brazeable metals and alloys.

Included are extremely valuable section on testing, quality control, safety, health protection and detailed explanations of causes of defects and how to correct them.

Copies of the hard covered book are available at $4.75 per copy from the American Welding Society at 33 West 39th St., New York 18, N. Y. or from Reinhold Publishing Corp., 430 Park Avenue, New York 22, N. Y.

How to Weld at Home

A new 128-page book of welded projects in iron and steel that can be made in any home shop has been published by Lincoln Electric Co. Included in the book are over 80 ideas in home maintenance and decoration with complete plans, photographs and suggestions for making them.

Explained in detail is the company's new "Selfwelding" process which requires no special skills and can be done with equipment within the means and ability of average householder. By eliminating some of the skills normally required for welding, the method is said to make welding almost as easy as turning on a light switch. In addition to welding, the Selfweld process can be used to cut, heat, braze and solder.

Book costs $1.00 in U.S.A. and $1.50 elsewhere, is printed in large type on good paper and is bound in stiff, cloth-covered binders, embossed in gold. Publisher is Lincoln Electric Co., Cleveland 17, Ohio.

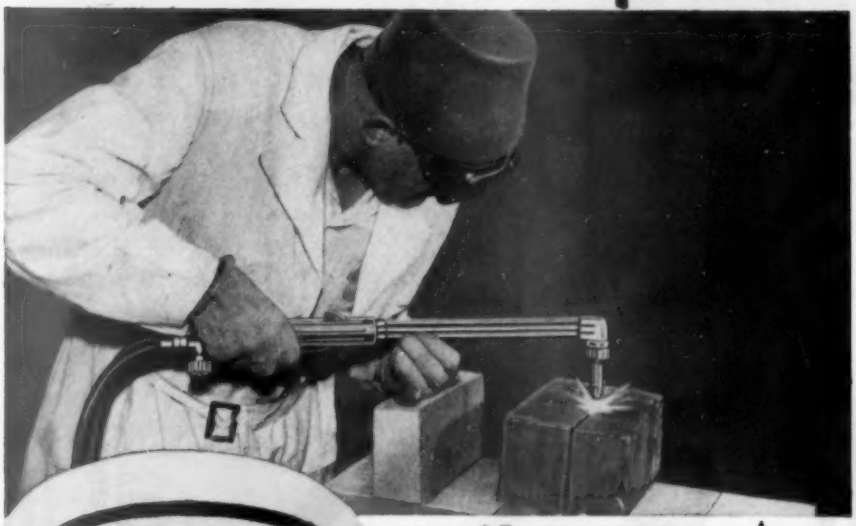
How to Form Austenitic Chromium-Nickel Stainless

A revised and expanded edition of "Forming of Austenitic Chromi-minute details of how to form these steels. Descriptions of newly devoloped processes, especially those using only one solid die, and their application to forming of stainless steel are included, along with detailed discussions of older and more conventional methods.

The book explains the effect of various compositions, tempers and finishes on forming characteristics. It contains 394 pages with complete index, bibliography, 30 tables and 293 detailed drawings.

Copies are available by sending order with check for $5.00 per copy to Direct Mail Circulation Section, International Nickel Co., Inc., 67 Wall Street, New York 5, N. Y.

Light weight torch cuts 4" steel-*FAST*-at low pressures



SMITH'S **Silver Star☆ CUTTING TORCH**

This is a light torch—only 2 lbs. 9 ozs. for the 20½" length. But, the way it cuts thick steel at low gas pressures is something to see. Eight pounds is all you need to cut up to ½" steel. For heavier cuts, pressures are proportionately low. Oxygen consumption reduced by 50% in some cases. That's real economy!

Another thing: You don't need a wrench with this torch! Tips slip into torch head, tighten with twist of fingers. That's a time saver! (Special Smith patent.) Lever Over Handle, Lever Under Handle, or Trigger — you have all 3 in this one torch to suit all operator requirements. Ask us for complete details on this sensational new cutting torch.

Full information on request — mail coupon

SMITH WELDING EQUIPMENT CORP.
DEPT. IW-171 • 2633 S.E. 4th Street • Minneapolis, Minn.

Circle No. 19 on Reader Service Card.

NO SINGLE WELDER WILL DO IT ALL!

THERE'S EXACTLY

THE RIGHT **miller** WELDER

TO MEET EVERY WELDING REQUIREMENT

MILLER SR RECTIFIER TYPE DC ARC WELDERS

Available in 200, 300, 400 and 600 amperes, it is a superior direct current welder using Miller Unitran transformer control and selenium rectifiers for conversion from 3 phase AC line current. Miller SR Welders feature widest possible current range, extreme arc flexibility, maximum electrode deposition rate and highest electrical efficiency.

THE *New* MILLER SRH RECTIFIER TYPE DC ARC WELDER

A new concept in welder design for all DC metalic arc welding. Available in 200, 300 and 400 amperes. It is ruggedly constructed, compact, and is designed to lend itself to stacking for parallel operation or to conserve floor space. It has single range control and is weatherproof.

Circle No. 20 on Reader Service Card.

THE *New* MILLER MULTI ARC COMBINATION AC-DC WELDER

Available in 14 models, this new Miller Welder provides both AC and DC welding power for applications where both are required. It operates from a single phase power line and is available with high frequency and controls designed especially for inert gas arc and spot welding.

MILLER ARC WELDERS FOR TUNGSTEN ARC WELDING PROCESS

These Miller Welders feature the patented Miller UNITRAN control circuit which combines the transformer with its own integral flux diverter. This, in conjunction with adequate open circuit voltage, high frequency, balancing resistor and optional controls insures superior uniformity and flexibility throughout the entire welding range. Available in nine models.

MILLER 100 SERIES HEAVY DUTY INDUSTRIAL TYPE AC WELDERS

Designed for heavy production welding and automatic welding applications. Available in eight models. The 100 Series Welders permit faster welding—as much as 35% faster. Movable coil design and 80 volts O.C.V. produces uniform and better welding characteristics throughout the entire range of the welder.

Write today for complete information on these Miller Welders.

ARC · SPOT miller GENERATORS WELDERS

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ELECTRIC MANUFACTURING CO., INC.

P.O. Box 798 Appleton, Wisconsin

"... if it's MILLER you know it's the finest..."

Circle No. 20 on Reader Service Card.

Literature Featured In Ads This Month

(CIRCLE ON ENCLOSED POSTCARD NUMBERS OF LITERATURE YOU WISH TO RECEIVE)

6 **Complete line of brazing alloys** is described in booklet. UNITED WIRE & SUPPLY CORP. Page 6.

7 **7-inch portable electric sander** for weld grinding and finishing is described in literature. BLACK & DECKER MFG. CO. Page 7.

8 **Automatic welding wires** for every application are featured in Folder DH-402. PAGE STEEL & WIRE DIV. Page 8.

9 **Resistance welding catalog** features complete line of dies, electrodes and holders. P. R. MALLORY & CO., INC. Page 9.

12 **How to choose a positioner** is subject of Bulletin R-1700-B15. WORTHINGTON CORP. Page 13.

13 **Portable 200 amp welder** is described in folder which explains free trial offer. KASSON DIE & MOTOR CORP. Page 14.

17 **Precision drawn fabricated wire** for automatic and semi-automatic hard facing is introduced and samples offered. DRAWALLOY CORP. Page 19.

18 **Hot Rolled Carbon Steel Structural Shapes** are featured in 71-page book. Also available is steel supply stock list and literature on Cor-Ten steel. U. S. STEEL SUPPLY DIV. Page 21.

19 **Lightweight cutting torch** is described and illustrated in new literature. SMITH WELDING EQUIPMENT CORP. Page 23.

21 **Arc welding machines** of every type for every application are featured in literature. NATIONAL CYLINDER GAS CO. Page 27.

23 **Compete buyers guide** features complete line of alloys and fluxes for welding, brazing, soldering, cutting and tinning. ALL-STATE WELDING ALLOYS CO., INC. Page 30.

27 **Compete data sheet** features new iron powder low hydrogen electrodes. Applications and welding procedures are given. ALLOY RODS CO. Page 33.

28 **Heavy-duty sander-grinder** built specifically for weld grinding and sanding operations is featured in Folder SG2. MILWAUKEE ELECTRIC TOOL CORP. Page 35.

29 **Silver brazing story is told** in Bulletin 20 which features complete line of silver brazing alloys. HANDY & HARMAN. Page 36.

30 **From connectors to ovens . . .** that's the range of equipment and accessories described and illustrated in new accessories catalog. METAL & THERMIT CORP. Page 37.

31 **200-Amp Engine-driven welder** with seven exclusive features is introduced in Bulletin GEC-1333, Section 714-1E. GENERAL ELECTRIC CO. Pages 38-39.

34 **Positioning equipment** for automatic welding is featured in literature which also describes complete line of positioners and turning rolls. ARONSON MACHINE CO. Page 51.

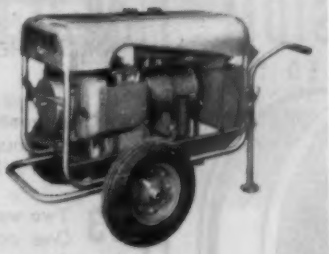
Circle No. 21 on Reader Service Card. →

Sureweld A-C SHOP WELDERS—For general repair and light production work. 3 models.

Sureweld A-C INDUSTRIAL WELDERS—For heavy duty production welding. 9 models.

Sureweld Gasarc A-C WELDERS—For tungsten electrode inert-gas welding. 5 models.

Sureweld D-C RECTIFIER ARC WELDER—For manual and automatic welding—tungsten or metal electrode inert-gas welding



Sureweld PORTABLE D-C ARC WELDER—Gas driven welder for field welding and maintenance work.

Sureweld CONSTANT POTENTIAL WELDER—For automatic or semi-automatic welding—metal electrode inert-gas or submerged arc welding.

Before you buy any welder... Examine the NCG® line...and compare

Are you in the market for a welder? Whatever the type you need, whatever the capacity, be sure to see the NCG *Sureweld* line. Each type of *Sureweld* welder has superior features that distinguish it from other makes . . . features you'll like, features your operator will like. Check the design, the construction, the performance, the easy operation, the power consumption. Ask for names of *Sureweld* users in your locality. Find out what kind of performance *they* get.

Call your NCG dealer or nearby NCG office for the facts about *Sureweld* welders . . . about operating ease, performance, costs. Or write for literature to the address at the right.

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Circle No. 22 on Reader Service Card.

35 **Weld grinding wheels** in a variety of shapes, sizes and specifications are featured in Bulletin 481. BAY STATE ABRASIVE PRODUCTS CO. Pages 52-53.

36 **Tubular alloy wires** for hardfacing applications are featured in brochure. STOODY COMPANY. Page 57.

37 **Right before eyes** is where you can find safety equipment and protective clothing; that is, if you get new safety catalog. CHICAGO EYE SHIELD CO. Page 58.

40 **Specifications on all sizes** of acetylene cylinders are available. NORRIS-THERMADOR CORP. Page 66.

42 **Advantages of positioned welder** are outlined in Bulletin Wp-26. CULLEN-FRIESTEDT CO. Page 70.

43 **Two welding manuals** are offered. One covers welding engineering, the other, truck and car fleet maintenance. EUTECTIC WELDING ALLOYS CORP. Page 71.

44 **Versatile oxy-acetylene welding** and brazing torch is highlighted in Catalog 818. AIR REDUCTION SALES CO. Page 75.

45 **Electrode holders** with "quick-disconnect" feature are explained in Bulletin 121. CAM-LOK DIV., EMPIRE PRODUCTS, INC. Page 76.

52 **Cable reels** for storing and paying out arc welding cable are featured. UNITED SPECIALTY CORP. Page 88.

55 **More profit dollars** is title of interesting brochure which describes

(Continued on Page 30)

HIGH conductivity forgings and castings for all resistance welding needs..

WE MAKE THEM
OURSELVES....
....WE *KNOW*
THEY ARE RIGHT

Seam Welding Wheels
Bushings • Knees
Shafts • Spindles • Etc.

Experience and technical skill identify WW ALLOYS. Long a leading reliable source of high conductivity, high strength forgings and castings—in rough or finished form—WW ALLOYS can meet any resistance welding requirement. And with the added advantage of WW's participation in Fansteel's continuous metallurgical research, you know you can count on WW for the job being right every time.

depend on* WW *for metallurgical know-how and specialized experience

W545

ONE OF THE FANSTEEL INDUSTRIES

WW ALLOYS, INC.

Division of Fansteel Metallurgical Corporation

11644 CLOVERDALE AVENUE, DETROIT 4, MICHIGAN

Circle No. 66 on Reader Service Card.

contour cutting equipment for use on pipe and tubing. H & M PIPE BEVELING MACHINE CO. Page 89.

58 **44-page book** with 25 illustrations is issued to tell the story on regulators, what they are and what they do. NATIONAL WELDING EQUIPMENT CO. Page 93.

62 **Arc and oxy-acetylene** welding equipment and accessories are featured in two free catalogs. LIQUID CARBONIC CORP. Page 97.

63 **Comprehensive new catalog** lists a complete line of resistance welding electrodes, holders and dies. TIPALOY, INC. Page 63.

64 **Tungsten electrode inert arc welding** is subject of literature. ELMET DIV., NORTH AMERICAN PHILIPS CO. Page 99.

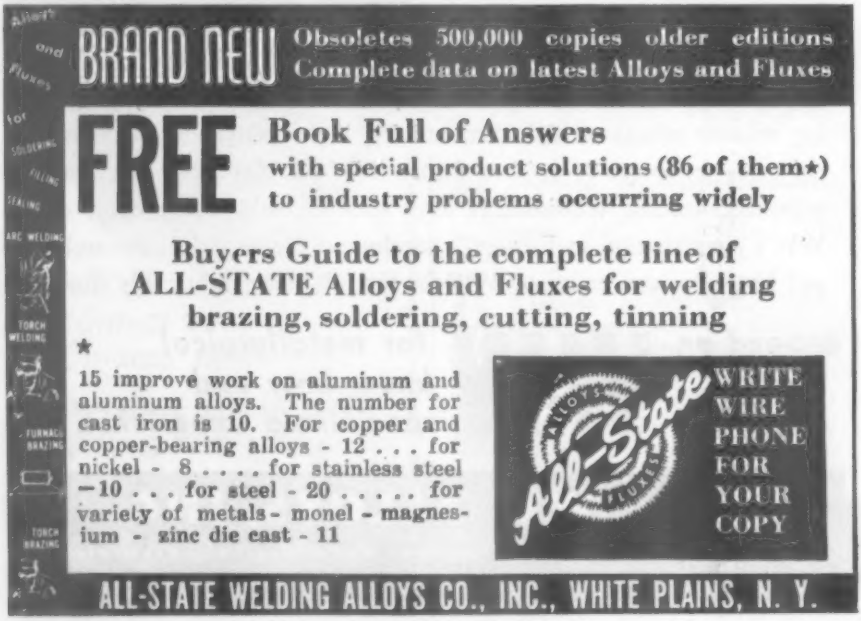
72 **Carbon welder brushes** and carbon products of all kinds are featured in catalog. BECKER BROS. CARBON CO. Page 110.

76 **Complete clamp catalog** features complete line of clamps for welding and other industrial uses. CINCINNATI TOOL CO. Page 114.

80 **Welding rod and repair shapes** for welding of manganese steel castings are featured in Bulletin No. 451. TAYLOR-WHARTON IRON & STEEL CO. Page 116.

84 **Protective clothing** for welding operators is featured in descriptive catalog. ALJAY MFG. CO. Page 118.

88 **Story of constant voltage welders** is explained in literature available. GLENN COMPANY. Page 119.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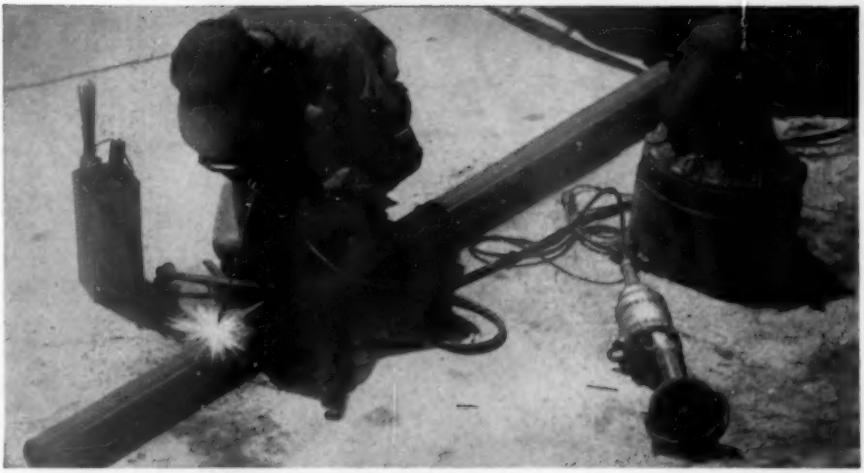

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Want more information? Send for Inco's new folder called "Repair Cast Iron Parts Quickly and Easily". It shows you some of the many castings that others have repaired successfully with NI-ROD and NI-ROD "55" electrodes.

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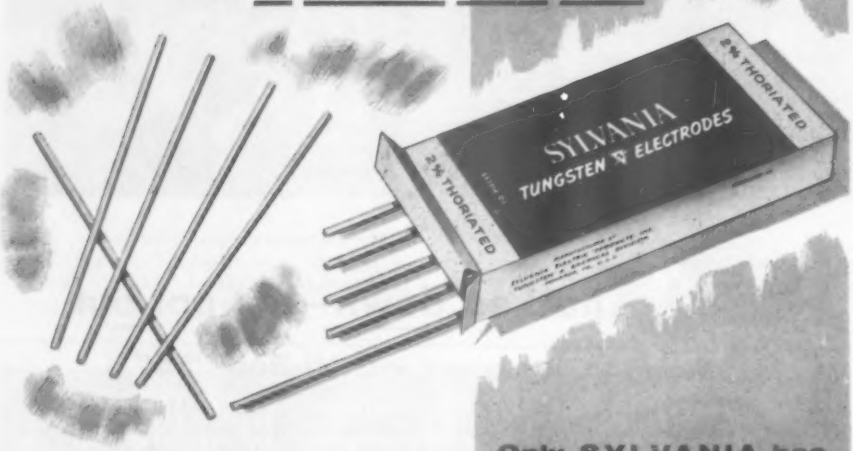

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For nearly thirty years, the Henry Pratt Company of Chicago has specialized in the designing and building of many types of butterfly valves. The fabricated body shell illustrated above is an example of an unusual butterfly valve made for an unusual service. Installed in a closed-circuit controlled-atmosphere wind tunnel, this Stressed Seal® Butterfly Valve must withstand transonic velocity air streams at temperatures ranging from —100° F. to +650° F.

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The cost-saving experience of the Henry Pratt Company has been duplicated in plant after plant. That is why it will pay you to use ATOM • ARC . . . the *all-position*, iron powder, low hydrogen electrode.

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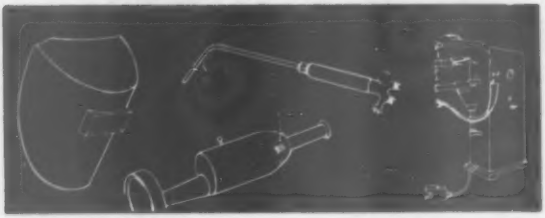

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KEWANEE-ROSS CORP., Div. of American Radiator & Standard Sanitary Corp. use SIL-FOS in making ROSS Heat Exchangers. Here a copper shell is torch brazed into a bronze hub — 31" around — in only 5 to 6 minutes.

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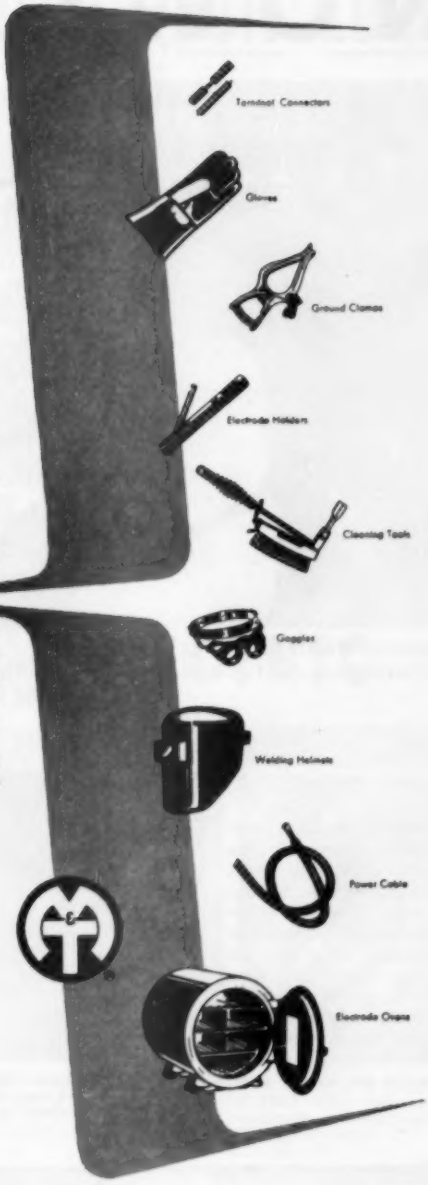
For a copy of the M & T accessories catalog contact your nearest M & T branch office, or write.



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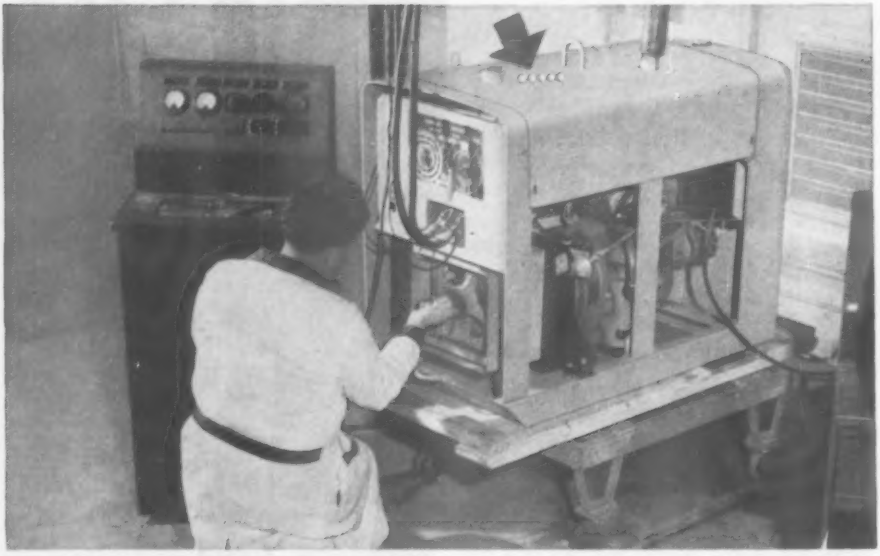
NOW! Steady Output



5 NICKELS STAND ON END as new G-E 200-amp welder runs at full load. Steady operation indicates advanced engineering which makes G-E welder best performance buy.

PROVE IT TO YOURSELF—Compare the new 200-amp G-E engine-drive welder with two other welders of the same rating. You will see that only the new G-E welder has so many advanced design features for better welding performance at lower cost.

ELECTRODE SELECTOR, CURRENT DIAL—Dual controls provide easy, accurate current adjustment.

NON-PROJECTING GENERATOR—No vital parts exposed. Full-length base fully encloses generator.

PUSHER ENGINE FAN blows air outward, helps prevent vapor lock.

GENERAL ELECTRIC	✓	✓	✓
MANUFACTURER A			✓
MANUFACTURER B			

Hour After Hour, at Full Load

. . . WITH GENERAL ELECTRIC'S ALL NEW 200-AMP ENGINE-DRIVE WELDER

General Electric's new 200-amp engine-drive welder maintains steady output and 100% arc stability—hour after hour—even when operated above full load.

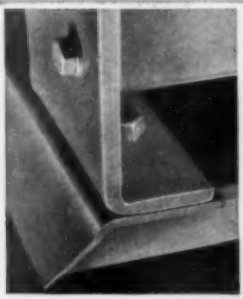
This is made possible by combining a direct-connected Hercules engine with a generator specially designed for field use. In addition, no matter what type or size of electrode you use, or where you set the controls, this G-E welder provides complete freedom from "popouts". This is due to the high recovery voltage of the welder.

Six months of rigorous in-the-field testing by 18 pipeline welding operators has already proved that the new G-E engine-drive welder has that extra punch needed for top performance in job shops, on construction, and similar welding operations. Check the feature-by-feature comparison chart below and see why.

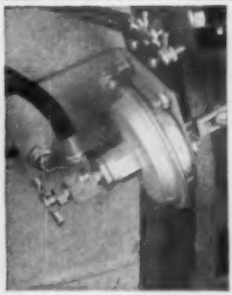
For more information, write for bulletin GEC-1333, Section 714-1E, General Electric Co., Schenectady 5, N. Y., or contact your local G-E Welding Distributor. He's listed in the yellow pages of your phone book. Ask him also about G-E's new construction electrodes—W-610A and W-710A.

GENERAL ELECTRIC

CONSTANT-PRESSURE BRUSH SPRINGS reduce adjustments.



HEAVY GAUGE METAL THROUGHOUT — 16 gauge canopy, 3/16" channels and 1/4" cross-bars.



OVER 12-HOUR OPERATION —On a tank of gas—due to vacuum-operated slow-down control, 17-gal. tank.

SPRING-WOUND TRAILER AXLE reduces side-sway and weaving for easier towing.

✓	✓	✓	✓
	✓	✓	

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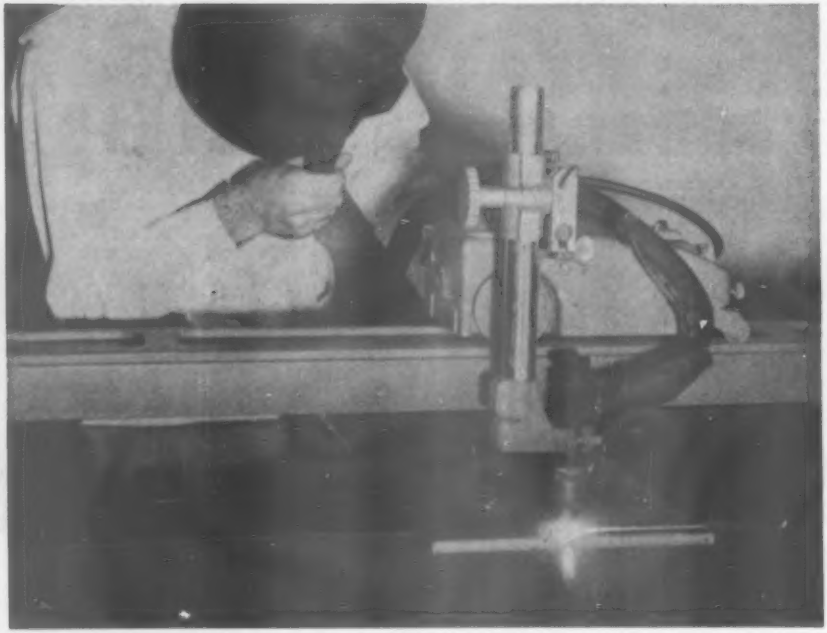
You can

CUT ALUMINUM PLATE

at speeds up to 300 inches a minute

using new inert arc process



Mechanized inert arc cutting with equipment shown here reaches speeds from 50 to 300 inches per minute depending on thickness of aluminum plate being cut. Expanded use of the process on other non-ferrous metals is indicated.

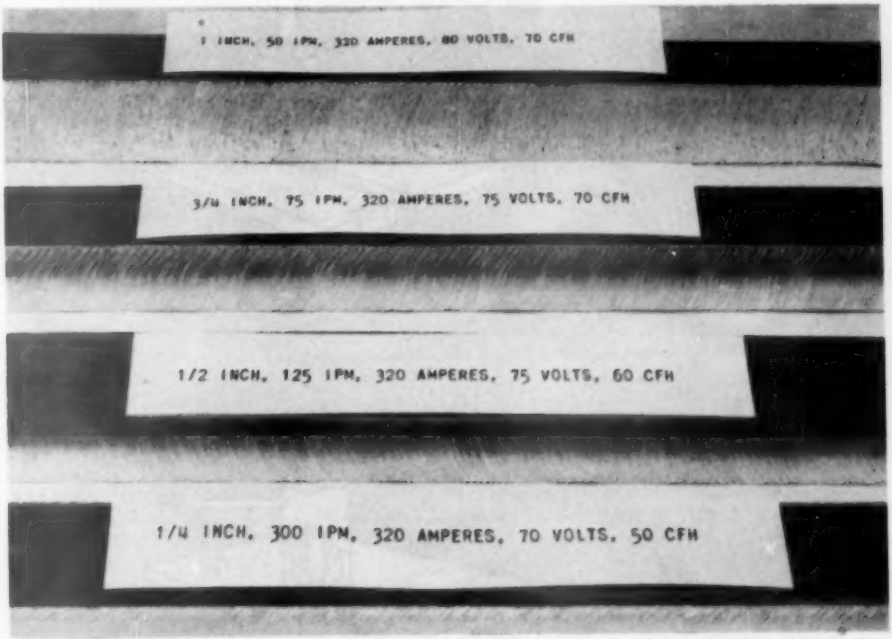
A REVOLUTIONARY new inert arc cutting process called Heliarc cutting uses an argon-hydrogen gas-shielded arc, increases ease and speed of cutting aluminum and produces clean, quality cuts at speeds up to 300 inches per minute.

Use High-Velocity Arc

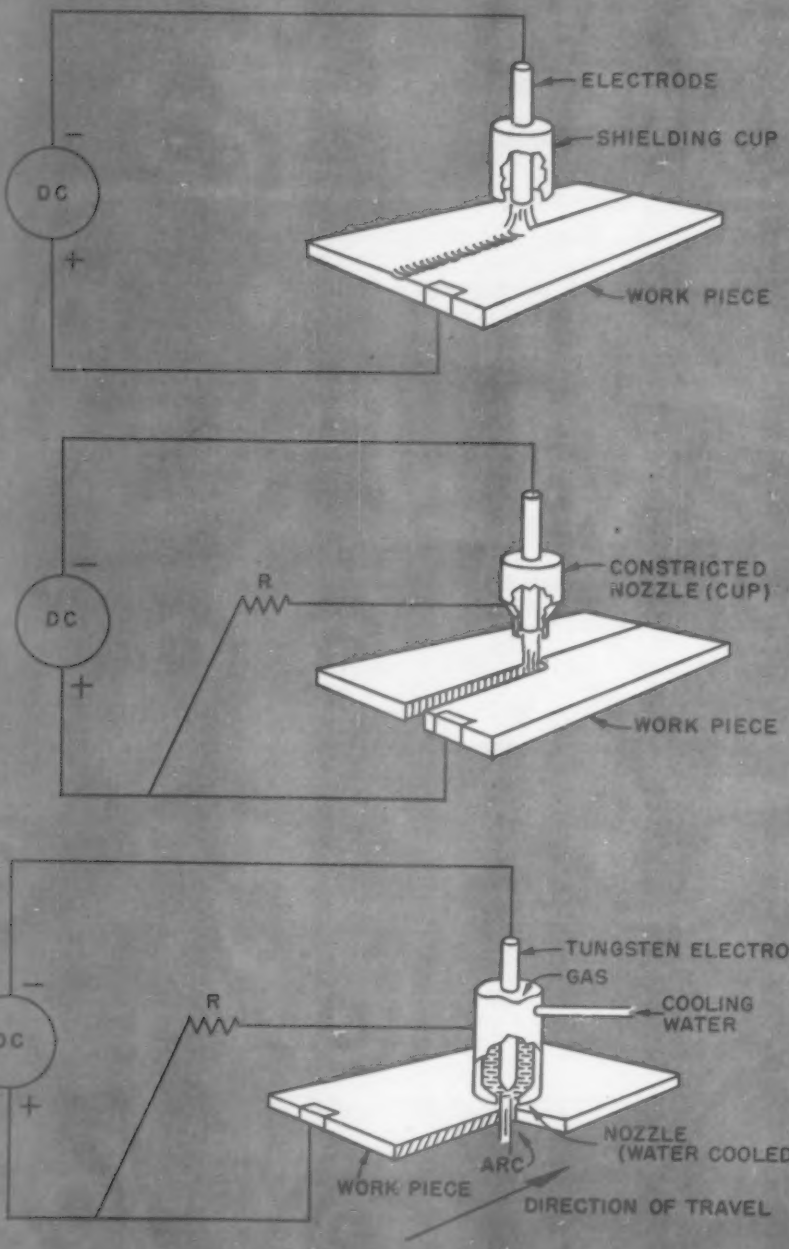
Heliarc cutting employs an extremely high-temperature, high-velocity constricted arc between a tungsten electrode and piece to be cut. The concentrated and columnated energy of the arc stream melts and ejects a thin section of metal to form a kerf. This jet-like action removes the molten metal mechanically, and the gas atmosphere prevents oxidation of the cut surface which can immediately be welded. Since the process is adaptable to mechanized and manual operation, it is expected to find immediate use in the aluminum fabricating industry.

Although non-ferrous metals are relatively soft, they cannot be cut easily. Until now, there has been no process which is to non-ferrous cutting as oxy-acetylene cutting is to steel; namely, a process which offers speed, ease of manual and mechanized operation, smooth cut surfaces, high efficiency and easy adaptability to position and contour.

Saws and planers, which had


1 INCH, 50 IPM, 320 AMPERES, 80 VOLTS, 70 CFH
3/4 INCH, 75 IPM, 320 AMPERES, 75 VOLTS, 70 CFH
1/2 INCH, 125 IPM, 320 AMPERES, 75 VOLTS, 60 CFH
1/4 INCH, 300 IPM, 320 AMPERES, 70 VOLTS, 50 CFH

These clean, saw-like cuts were made in aluminum using mechanized equipment, 100 volts open circuit voltage and 65-35 mixture of argon and hydrogen shielding gas. Indicated is speed, amps, volts and gas flow in cubic feet per hour.


ELECTRODE
SHIELDING CUP
DC
−
+
WORK PIECE
R
CONSTRICTED NOZZLE (CUP)
TUNGSTEN ELECTRODE
GAS
COOLING WATER
NOZZLE (WATER COOLED)
ARC
DIRECTION OF TRAVEL

New inert arc cutting process can be used in any position: for cutting straight lines, bevels, circles and shapes. This 10-inch diameter circle was made in ½-inch aluminum plate at 60 ipm, using 260 amps, 75 volts.

been available for cutting or edge-preparing of non-ferrous metals, have generally been limited to straight-line cuts and necessary equipment is generally expensive. In the cases where irregular or curved shapes must be cut, band-saws or hand-chipping and drilling methods have been used.

The inert arc cutting process is said to bring all the features of flame cutting to the cutting of aluminum. Normal mechanized speeds range from 300 inches per minute in ¼-inch material to 50 inches per minute in one-inch material. Lower cutting speeds can be obtained by simply adjusting controls. Process can be used in any position; for cutting straight lines, bevels, circles and shapes.

For example, in the fabrication of aluminum tank cars, made of ⅝-inch plate, average hand cutting speed now obtained is approximately one-inch per minute using a combination of burning and chipping or drilling and chipping. In the same operation, average machine-planing speed for edge preparation, including set-up and handling time, is about 10 inches per minute.

Progressive schematic drawings show normal inert arc welding circuit (top), circuit changes, including addition of pilot-arc circuit and gas-nozzle constriction (center), and gas flow and constricted arc characteristics of cutting process (below).

Square, Saw-Like Edges

With the new process, speeds mentioned previously can easily be attained with mechanized operation. Speed and quality of manual cutting vary according to operator skill with an average speed of about 60 ipm on ½-inch aluminum plate. Kerf edges of all cuts have a saw-like quality, with square corners and no attached dross.

Basic equipment for the new cutting process includes cutting torch, control panel, high frequency unit

Inert arc cutting is to aluminum and non-ferrous metals what oxy-acetylene cutting is to iron and steel . . .

for starting (high open circuit voltage motor-generator unit), shielding gas supply, water supply and drain and necessary cables and connections. A travel mechanism is necessary for mechanized cutting.

Description of Equipment

Equipment is comparable to that used with Linde's inert arc welding process with certain exceptions. These include new collet and collet body made for manual and machine welding torches. This design of the torch makes the unit compact and places necessary tubes for water-cooling the nozzle inside the torch body. A completely different type of nozzle with replaceable insert has been fabricated, using an "O" ring construction. Several materials have been used to make inserts. The present model is equipped with one made of hard-drawn copper.

Another change is the inclusion of an additional electrical circuit called the "pilot-arc" circuit. This is used during manual operation to initiate the cutting arc. Incorporated into it is a hot-resistor which limits the current from the power supply to the nozzle.

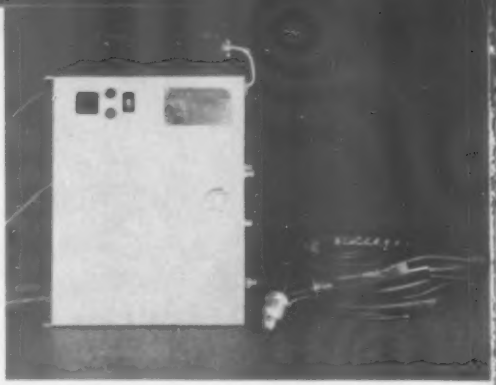
Use Two Starting Methods

Actually, two methods of starting are used. In mechanized cutting, a standard high-frequency unit, used in conjunction with the pilot circuit, initiates the cutting arc. In manual cutting, as noted above, a pilot arc in argon atmosphere is employed for starting.

An investigation was made to establish conditions for reliable starting using an open-circuit voltage of 100 volts and an atmosphere of 65 percent argon and 35 percent hydrogen. Starting was evaluated both with a pilot circuit and without one. In the latter case, tests were conducted with the nozzle connected to the electrode by a 100-ohm resistor.

The pilot circuit was found to be essential for satisfactory starting, but the pilot arc could not be maintained in the argon-hydrogen at-

(Turn to Page 46)



Basic equipment for manual inert arc cutting shown above resembles that used in manual inert-arc welding.

Speed and quality of manual cutting vary according to operator skill with an average speed of about 60 inches per minute on ½-inch aluminum plate.

NOW...RACO BRINGS YOU WIRE Packaged and Ready for Production Uses!

RACO "PAY-OFF-PAK!"

Now you can have steel wire in small diameters for welding with inert gas or CO_2, shipped ready for production use in 500 lb. package.

Each Raco "Pay-Off-Pak" consists of one continuous coil, *properly* coiled and cast to insure truly high production automatic welding for extended periods without interruption.

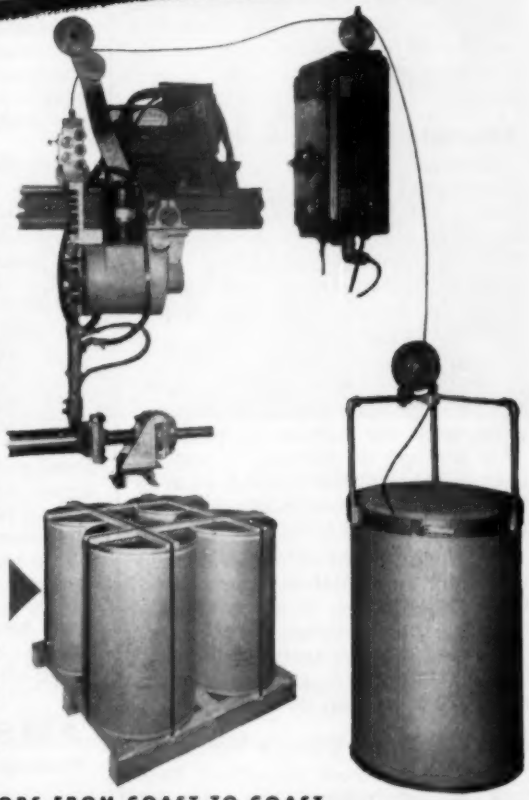
This wire is free from kinks, bends, twists, and crossed strands for positive wire feed at increased welding speeds. 500 lbs. of wire in one coil eliminates necessity of constantly changing and reloading of smaller coils.

Uniformity of wire is guaranteed throughout the entire coil by our quality controlled processing methods.

Four "Pay-Off-Paks" are shipped on a wooden pallet for convenience in handling and storage.

"Pay-Off-Pak" shipments can be furnished in all grades of carbon steel, low-alloy steel, stainless steel, and aluminum wire.

For further information, see your distributor or write us direct.



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mosphere. It was also determined that strength of the high-frequency unit had an influence on the reproducibility of starting when long arc lengths were employed. Using a standard high-frequency unit and nozzle-to-work distance of approximately ¼-inch, satisfactory starting was obtained. In addition, initial impulse of the high-frequency unit must contact the edge of the plate to insure reliable starting. Since the position of the torch in respect to edge of the plate can be preset in mechanized cutting, this method of starting is best adapted to machine operation.

Alternate Starting Method

Because the pilot arc can be maintained in an argon atmosphere, an alternate method of starting, using solenoids, was developed for manual cutting. The normal flow of argon was used to maintain the pilot-arc and to initiate the main arc.

Illumination of the pilot-arc permits the operator to locate the edge of the plate at the desired point even with his helmet in position. This method of starting is applicable to interrupted cutting, such as would be the case in manual operations.

When the point of cut is located and main arc initiated, the required flow of hydrogen is automatically injected immediately. At the conclusion of the cut, arc is automatically extinguished, and the argon and hydrogen stop flowing.

80 Volts Open-Circuit Voltage

One of the most important factors in determining the ease of starting and the maximum arc length that can be maintained using the argon-hydrogen mixture is the open-circuit voltage rating of the

(Continued on Page 87)

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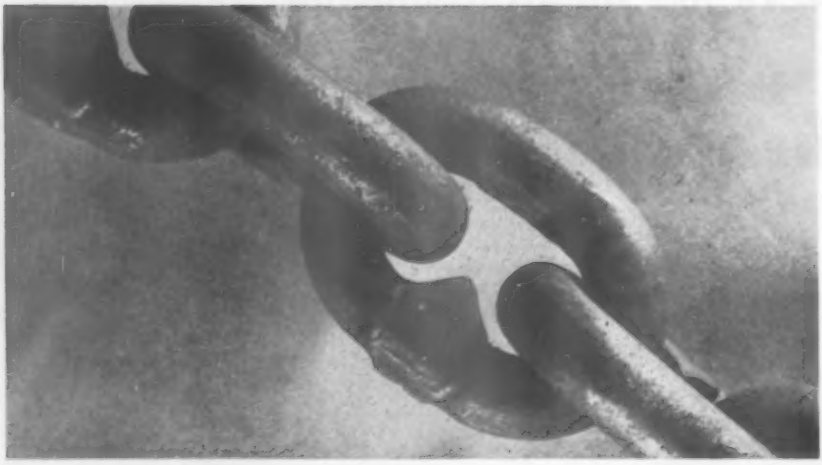


This ALL-WELDED CHAIN has

A NEW method of electric chain welding, developed by American Chain Division, American Chain & Cable Co., makes welds that provide 2¼ times the weld area found in normal flash or butt welded links. The result is the company's new Accoloy X-Weld 125, a chain with welds as strong, or stronger, than links themselves, welds that won't break when links are bent sharply, particularly when going over sharp objects.

Resistance Butt Welding

The new process is actually resistance butt welding, but is called cross-gap deep penetration welding because slight extrusions from link ends join at center of weld. However, instead of just joining butt ends of links, pressure is applied from top and bottom to two half round lugs that are actually forced down and welded into the joint where link ends meet. Lugs do not actually meet at the center of the weld, as do link ends, but their surfaces fuse with those of link ends to give the added weld area. Completed welds in cross section look much like a double V butt weld; hence, the X-Weld description.

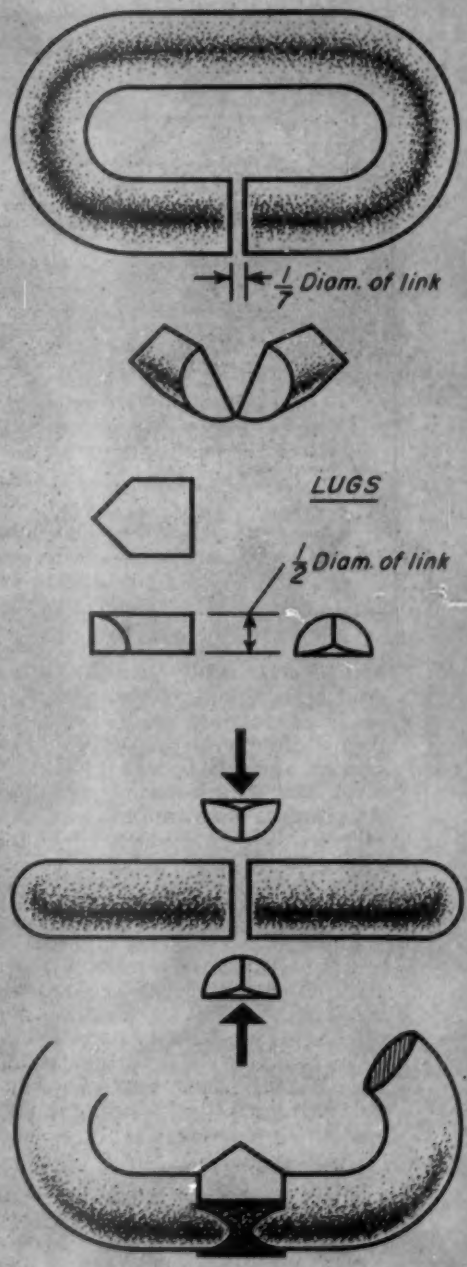
No edge preparation is required on link ends. Lugs are blanked from half round wire of the same diameter as links on which they are used.

The new process has some big advantages.

First of all, insertion of lugs into weld area stiffens link sides, giving increased resistance to side bending. The lug is designed so that it will not bend under standard test until 100 percent overload has been applied. However, even when sufficient overload is finally

Inserting and welding separate pieces of steel between butted ends of formed chain links increases weld area 225 percent and produces a weld that is stronger than chain link itself.

Inserted metal becomes a stop midway in the link so that kinking is impossible and chain always hangs straight. Chain will not bend until 100 percent overload has been applied; then, it does not bend at weld, but adjacent to it.



NO WEAK LINKS

applied to bend the link, it will not bend at the weld, but adjacent to it.

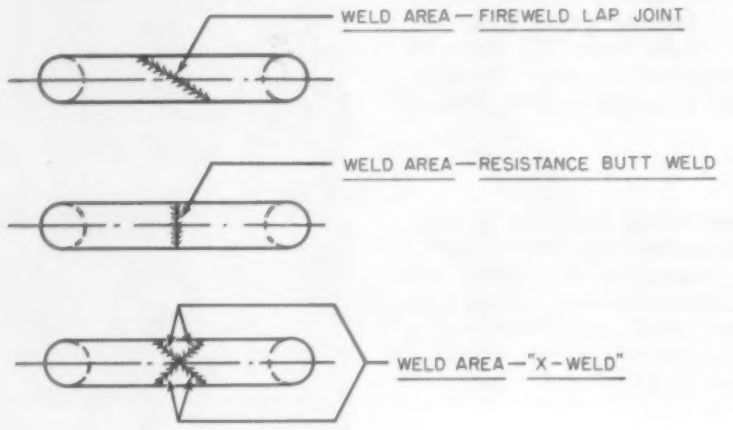
Increased Deformation Resistance

Insertion of lugs yields another benefit. Lugs give increased resistance to deformation under crushing loads and high temperatures. These properties were formerly secured chains which have a stud link or cross bar welded into place in a second operation after chain has been welded in regular manner. Lugs eliminate this second operation and cut costs considerably.

Actually, stronger welds give increased strength which permits use of much higher "tested" safety factor.

Join Any Metal

Another advantage of the new process is that any weldable metal



Cross-sectional drawings show advances in chain making. Increased weld area of new joint insures much greater safety factor. Lap joint proved impractical for use with resistance welding.

can be successfully joined. So far, American Chain has joined links made of puddled iron, white cast iron, aluminum-bronze, silicon-bronze and all types of stainless steel. Nor is link size any problem. At present, links ranging in diameter from ¼ to ¾-inch are being joined. It is expected that eventually links up to 2-inches in diameter will be x-welded.

Finally, there is no division of current with the new process. Current does not travel around the back of the link causing an approximate 40 percent current loss as in ordinary flash or butt welding. Rather, great heat is generated in a short time, yielding sound, high quality welds.

Here's how it's done.

Links are formed in conventional fashion, except that a slightly larger gap — about 1/7th of link diameter — is used. These gaps are made as chain is formed in continuous links. They are no harder to secure than those used ordinarily.

Lugs are fed from a magazine into the welder. Feed setup will eventually be changed to hopper-feeding to speed up loading.

Special Machined Electrodes

Chain lengths are put into welder and one link at a time is fed into welding position. Link to be welded is held in position by four clamps that permit no appreciable movement during welding. Lugs are fed into top and bottom electrodes which are specially machined to accommodate them. Electrodes are made of R.W.M.A. Class 3 alloy. Top lug is held in place in upper electrode by a vacuum.

Cam motion then moves lugs into

(Continued on Page 88)

Steady, Positive, Precision Rotation for AUTOMATIC WELDING with *Aronson* Positioning Equipment.

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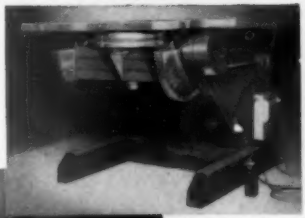
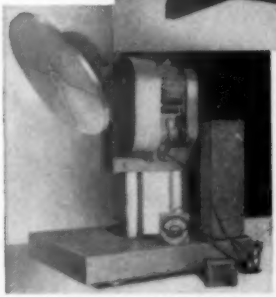
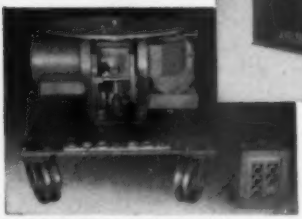


Heavy Duty Precision Built Rubber and Steel Tired Turning Rolls, 100% overload protected. Capacities to 150 Tons. Also Tilting Rolls, Pipe Rolls and Rail Cars.



Heavy Duty Gear Driven Positioners, with Magnetic Braking, Mercury Grounding, and Optional Speeds. Capacities to 24,000 lbs.



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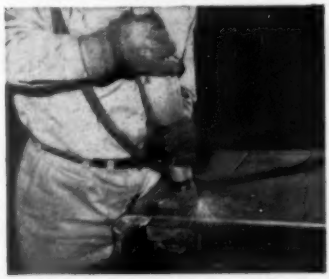

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Made from .040-inch thick arc-cast molybdenum, gas-turbine guide vane (above) is warm stretch-formed and brazed with AMS 4775 alloy in a hydrogen atmosphere.
Arc welded from arc-cast molybdenum sheet, 6-inch diameter nozzle (left) has two conical sections and a flange. Critical dimensions are held by sizing operation after welding.

TECHNIQUES for WELDING and BRAZING MOLYBDENUM

MOLYBDENUM can be welded to itself by a number of different processes including arc and resistance welding methods. It also can be welded to those metals and alloys with which it readily alloys. In all cases absolute cleanliness of the molybdenum is essential.

The most satisfactory welds in heavy sheets and parts are probably those made with atomic hydrogen or inert gas shielded arc with tungsten electrodes, with or without filler metal additions. Manual arc welding is not feasible, but submerged arc welding has shown some promise.

Helium is preferred by some to argon because of the greater heat produced at the arc and the smaller width of the heat affected zone.

Precautions must be taken against the presence of oxygen. For example, welds are subject to cracking if oxygen content of argon atmosphere exceeds 0.2 percent, while ductility is drastically reduced by the presence of more

6 Basic Facts About Molybdenum

1. Arc-cast molybdenum can be welded without porosity and with freedom from cracks. This is generally not true of commercially available powder-metallurgy molybdenum.

2. Thin sections of molybdenum can be successfully welded by a number of methods. Although the weldment usually has appreciable room-temperature tensile ductility, bend ductiilty is low. The latter is related to the usual brittleness of unworked cast molybdenum (in the weld deposit) and to the brittleness of recrystallized molybdenum (in the heat-affected zone).
A noticeable improvement is evident at slightly higher temperatures such as 200/400°F. For example, a large aircraft company found that welded tubular section of arc-cast molybdenum can be expanded approximately 10 percent at 800°F despite room temperature brittleness of the welds. In some cases, ductility of the weld and heat affected zone may be improved by subsequent mechanical working. Lower ductility of welds may also be compensated for by suitable joint design.

3. Ductility of molydenum is adversely affected by even small amount of oxygen. For optimum ductility, welding should be done in a vacuum or controlled atmosphere. Unless they are specially purified, commercial argon, helium and hydrogen may contain sufficient oxygen to cause porosity and cracking.

4. Composition likewise affects ductility. An arc-cast alloy with 2° tungsten and 0.03 percent chromium and aluminum-deoxidized arc-cast molybdenum have lower transition temperatures (under 350°F) after welding than carbon-deoxidized arc-cast molybdenum and other molybdenum-base alloys that have been tested to date.

5. Molybdenum raises problems in some types of welding, particularly the resistance methods, because of its high melting point, high strength at elevated temperatures and high thermal conductivity.

6. Ductility of brazed joints may be superior to that of welded joints provided the time at temperatures above 1700°F is kept to a minimum. Brazing however, is not suitable for all uses.

than 0.05 percent.

Amperage and travel speed depend largely on the fixtures and chills used, and therefore, must be established by trial. A preheat at 400°F has been reported to give favorable results, but is not always necessary.

Filler wire lessens the need for highly accurate fitting of details and reinforces the weld, which is particularly desirable for parts to be stretched or formed after welding. Filler wire or unalloyed molybdenum or the 2% tungsten alloy has shown most promise.

Corner or edge welds are generally easier to make than butt welds, while butt welds in turn are generally simpler to produce than fillets.

Resistance welding of small molybdenum parts has been done in the lamp and electronic industries for many years. The latter frequently sandwiches nickel or platinum foils between the molybdenum sheet or wire to set a com-

"Molybdenum is metal which has a melting point of 4730°F, almost 2000°F higher than that of iron. This permits its use at temperatures above the softening points of most metals. The useful strength of molybdenum-base alloys is greater than of any known material at temperatures above 1600°F. Molybdenum's stiffness is a third greater at that temperature than steel at room temperature. Molybdenum has exceptional thermal-shock resistance and has a low specific heat. It has good electrical conductivity—about a third that of copper—and has high resistance to corrosion in many mediums, including some important liquid metals, such as molten sodium and lithium."

---

bination brazeweld. Either AC or DC welding equipment may be used. A condenser discharge type of welder, or an ignitron type with ½-cycle timer has been satisfactory.

If design permits, one of the sheets to be joined by projection welding, should be dimpled or sandblasted. In spot welding surfaces of both sheets should be etched by immersion for 10 seconds at 195°F in a solution containing five gallons of concentrated sulfuric acid, 375 grams of chromic acid, one quart of hydrofluoric acid and 0.1 quart of concentrated nitric acid. Sheets should then be immersed in hot chromic acid glass-cleaning solution until oxide disappears.

Problems in Spot Welding

In addition to the brittleness of the joint, the main drawback of spot or seam welding is sticking and deformation of electrodes. Copper, copper-alloy, molybdenum and tungsten electrodes have been tried but none has proved completely satisfactory. Insertion of thin tantalum foil between the molybdenum sheet and the electrodes has not solved the problem.

Favorable results on a more-or-less laboratory scale have been obtained with percussion and flash welding, as well as with simple pressure welding in a dry-hydrogen or oxygen-free argon atmosphere. At present, available equipment limits these processes to small sizes.

Molybdenum Can Be Brazed

Molybdenum can be brazed with a large variety of metals and alloys, the choice of which depends on the type of brazing equipment available, as well as on the ultimate application. Generally, controlled atmosphere furnaces, induction heating or resistance welding equipment is used. Experimental brazes can be made on well-fluxed molybdenum by an experienced operator with an oxy-acetylene torch.

Particular attention must be given to the selection of a brazing medium when the parts are to be subsequently given a protective coating. Temperatures involved in the latter operation are above the melting point of some of the brazes.

Where high service temperatures are not involved, copper (melting point 1981°F) or silver brazing alloys are usually chosen. A silver brazing alloy with 50% silver, 15.5% copper, 15.5% zinc, 16%

ROLL CRUSHER PRODUCTION TIME DOUBLED...

using Stoody Semi-Automatic Wires

Roll wear encountered in crushing extremely hard blue granite rock to critical specifications was limiting production at Arizona Sand and Rock Company's portable plant, near Phoenix. Every hour of running time had to be matched with an hour down for maintenance of the rolls! Days just weren't long enough to produce tonnages required and still keep equipment in shape... at least not by ordinary methods.

To avert an impending aggregate bottle-neck, management turned to the new Stoody semi-automatic hard-facing process, set up as a routine repair technique. Time required for maintenance was immediately cut in half... and the hours gained each day were converted to a much needed second production shift!

Low spots on the pair of 40" x 22" rolls are nightly built up as necessary with Stoody $\frac{7}{64}$" diameter Manganese. Corrugations are capped with Stoody 100. Both of these alloy materials are supplied in tubular wires for semi-automatic application. High deposition rates—7 to 15 pounds per hour—are several times faster than manual welding. Considerably less heat input is required than by other methods. Deposits are sound and free from porosity. No flux or flux dams block the weldor's view and stub end losses are eliminated.

By permanently installing the semi-automatic welder as part of the crushing equipment no time was lost preparing for nightly maintenance.

If you have maintenance problems on any of your heavy equipment, we'd suggest that you ask your Stoody dealer (check the "yellow pages") for new literature on STOODY ALLOY TUBULAR WIRES, or write direct.

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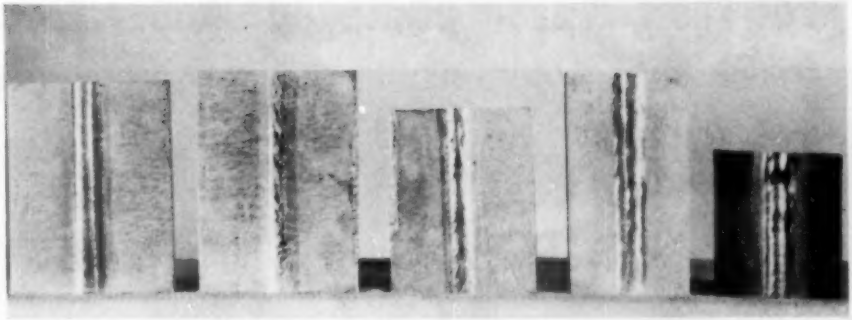


Welded samples of arc-cast molybdenum were made by inert arc welding, using helium shielding gas, tungsten electrode and .062-inch diameter molybdenum filler wire. Welds were made in ⅛ to ½-inch stock in from three to 13 passes.

cadmium and 3% nickel (melting point 1195°F) has given excellent service in brazing electric and electronic parts. One large producer recommends that wherever possible the base material should be presilvered with this alloy, cleaned, refluxed and then brazed.

EDITOR'S NOTE

The molybdenum and molybdenum alloys mentioned in this article are made by the arc cast method. A consumable electrode of molybdenum powder is melted and solidified in ingots up to nine-inches in diameter. These ingots can be readily converted by extrusion to billets, which in turn can be broken down into commercial products, such as sheets and bars.

Previously, metallic molybdenum was produced by the powder metallurgy process alone and was subject to limitations imposed by that process.

The addition of as little as 0.25% phosphorus to silver brazing alloys produced a marked improvement in the wetting of molybdenum surfaces, but about one percent phosphorus is required for maximum joint strength.

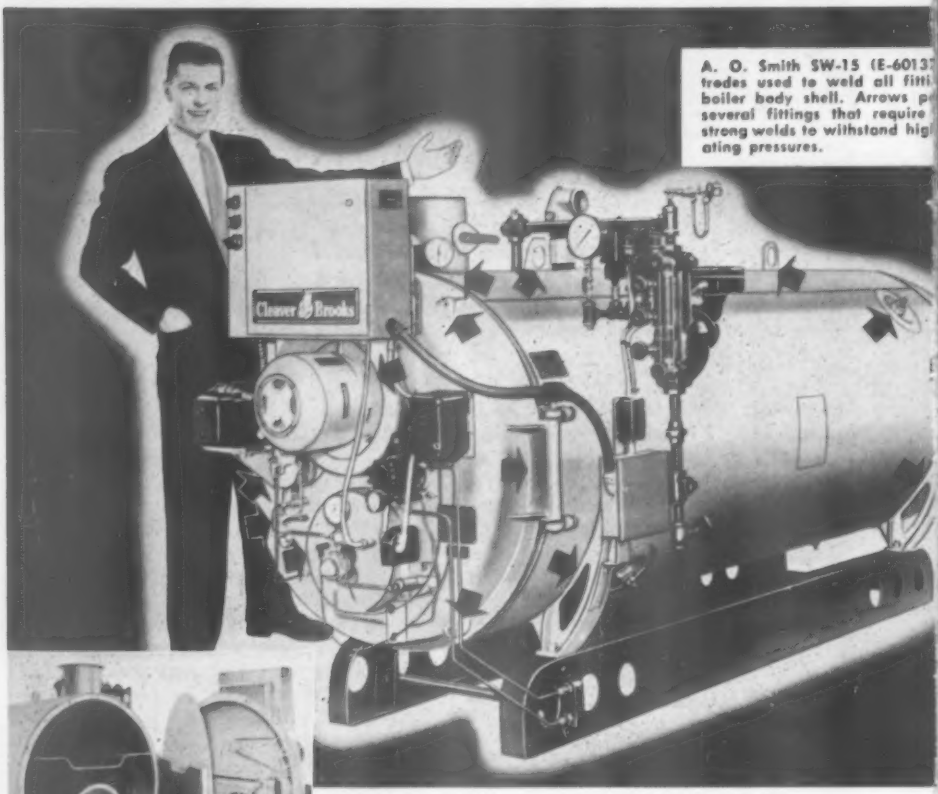
Relatively thin sheets can be easily brazed in a spot or seam welder. If all parts are well cleaned no flux is necessary. Copper alloy electrodes may be used, but tungsten-faced electrodes are better.

Heavier sections may be brazed without flux in a hydrogen furnace. Sometimes a preliminary nickel coating has been found useful, as in the brazing of a molybdenum cathode sleeve for magnetrons. The inside of the cone is coated with nickel powder and sintered prior to brazing with oxygen-free high conductivity copper brazing wire. The resultant nickel coating wets the brazing surface and later, in service, improves the thermal balance of the structure.

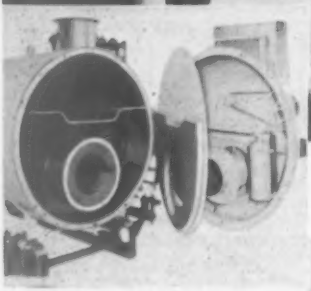
For electronic parts and other non-structural applications involving temperatures above the melting point of either copper or silver brazing alloys, nickel (melting point 2651°F) and platinum (3224°

(Continued on Page 89)

For their NEW "packaged" boiler Cleaver

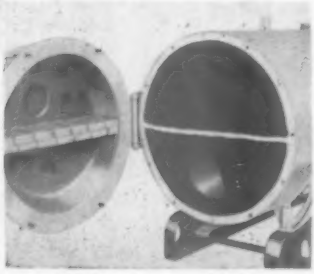


A. O. Smith SW-15 (E-6013 trodes used to weld all fitti boiler body shell. Arrows p several fittings that require strong welds to withstand hig ating pressures.



A. O. Smith SW-44 (iron powder) electrodes used in welding flanges on front head (top) and rear door assemblies. Because slag peels as they weld, SW-44 electrodes virtually eliminate cleanups.

America's top-line welding electrodes!



SW-15

Rated as world's finest high-production electrode for light gauge to heavy plate. High heat and speeds can be used without risk of undercut. Operates with quiet, smooth arc of medium penetration.

SW-44

A self-cleaning iron powder electrode for all jobs in AWS class E-6012. This weld-rod deposits far more weld metal . . . easy to restrike even when rod is cold.

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-Brooks chooses A. O. Smith electrodes for

all manual welds

A. O. Smith SW-15 and SW-44 weld-rods used for production welding of Cleaver-Brooks boilers

WHEN Cleaver-Brooks started production of new streamlined CB Boilers, they selected A. O. Smith electrodes—SW-15 and SW-44. Welds must, of course, be perfect to withstand 1½ times design pressures, and actually they test out far in excess of ASME code requirements.

The SW-15 electrode produces an easily-controlled, forceful arc with deep penetration in all positions. And, the easy-to-use SW-44 iron powder electrode produces excellent beads—flawlessly smooth and practically self-cleaning.

If your products demand quality welds every time, it will pay you to buy A. O. Smith electrodes. Call your A. O. Smith distributor today, or write A. O. Smith Corp., Welding Products Division, Milwaukee 1, Wis.

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Because welding is our full-time business, we offer you America's finest welder-proved electrodes, machines and accessories.

The man from A. O. Smith—
Roy Norton is the A. O. Smith Distributor who services the Cleaver-Brooks account. He's not only a salesman but a welding specialist as well.

Through research ... *a better way*

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CORPORATION
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Milwaukee 1, Wisconsin
International Division: Milwaukee 1, Wisconsin

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To insure standard welding conditions groove and spacing is checked closely by Professor S. V. Williams and welding operator. A 1/16-inch opening is maintained.

To determine electrode consumption, electrodes are weighed and counted for each weld. Stubs and remaining electrodes are checked when welds are completed.

Which Bevel for Pipe Welding?

A series of pipe welding tests was sponsored by Northern Natural Gas Co. to determine if the 37½° bevel joint, recently made the API standard, is more efficient than the now optional 30° bevel joint. Results proved conclusively that the latter is cheaper, stronger and easier to make.

A RECENT change in pipe welding specifications has made the 37½° bevel the American Petroleum Institute standard and the 30° bevel, previously specified by joint API-American Gas Association action, optional. This change has met with considerable opposition by many companies which feel there are no supporting facts for such a change.

One such company is the Northern Natural Gas Co. of Omaha, Neb. A pioneer in pipeline welding, this firm feels the wider bevel should offer some definite advantages over the 30° bevel to justify added construction costs which are thus brought about. The company thinks that if there are pipe consumers who desire other than the 30° bevel, it should be set forth in some manner so as not to be an en-

Molten weld metal receives close attention. Visual observation is made as each weld progresses. Welding is done from top center to bottom center on each side of pipe. Including root pass, welds are made in successively orderly sequence. No delays are permitted between passes while making 94.2-inches of weld.

cumbrance to pipeline construction.

Pipe mills also frown on the optional feature, as it could result in their stockpiling the wrong bevel for a prospective customer who might want immediate delivery on one only to find stock available on the other.

Conduct Series of Tests

To prove its point, Northern had the Engineering Department of the University of Omaha conduct tests on welds made by Northern's operators at the company's South Omaha warehouse. These were made on field welded pipe nipples with 30° and 37½° mill bevel, using positioned manual shielded metal arc welding.

The University of Omaha was selected to analyze and report on the tests because of the affiliation of Professor S. V. Williams with that school. Well known in the pipe industry, Professor Williams has qualifications and experience which made it possible for him to make an authentic and unbiased report.

Welding was witnessed by A. G. Barkow, Natural Gas Pipeline Co. of America; Fred Zilm, Service Pipeline Co., and L. J. Cunningham, assistant superintendent of pipelines for Northern Natural Gas.

Results of the study showed three things.

First of all, quality of field pipeline welds would not be improved by going to a 37½° mill bevel over the standard 30° mill bevel which has been in use since 1928.

Increase Electrode Consumption

Secondly, this change in mill bevel angle would increase pounds of electrodes required per weld and the amount of deposited weld metal by a minimum of 28.8 percent and

Careful attention was paid to detail during tests. Stop watches were used to make accurate check of time required to complete each weld (above), while tong-type ammeter was used to check welding amperage (below).

consume 26.5 percent more time per weld with a possibility of more due to excessive burn through on the 37½° mill bevel.

Finally, tests indicate that greater safety and improved quality would *not* be obtained. If anything, facts seem to indicate that the 30° bevel is more desirable.

Based on results of these tests, it was recommended that several mill bevel angles of less than 30° be given similar tests, so a tolerance could be established on the best mill bevel which would be more realistic than the one proposed.

It was further recommended that before changes to standard practices are made, all interested parties be allowed to present facts and evidence to be used in setting up changes in existing standards.

Use E-7010 Electrodes

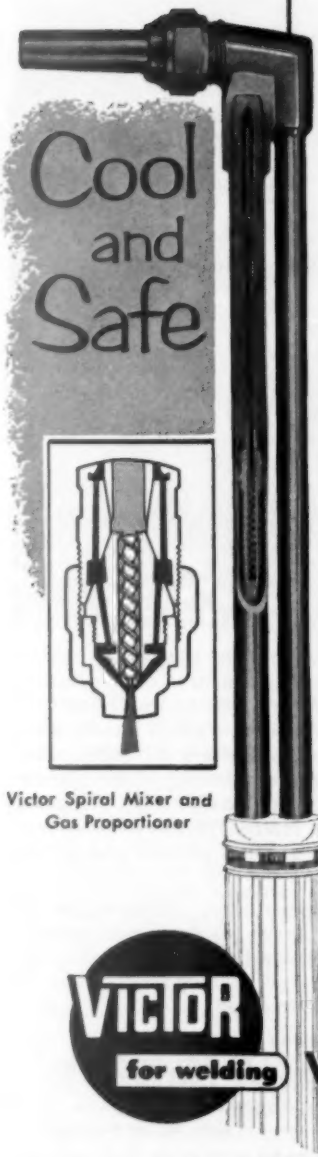
Pipe material used in tests was taken from stock of the Northern Natural Gas Co. The 30-inch diameter .375-inch wall pipe nipples compiled with ASTM and API standards for field welded pipelines. Electrodes selected were of E7010 classification and complied with tentative API standards.

Welding was done with direct current, reverse polarity at suitable amperage. E7010 electrodes were used throughout, including root pass.

Position welding was done on all four pipe nipples welded. Direction of travel was down from top center to bottom center on each side of pipe.

Operator Has Helper

An operator and a helper were used on the root pass and each succeeding pass until welds were completed. Including the root pass, each one followed in a successive orderly sequence. No delay was



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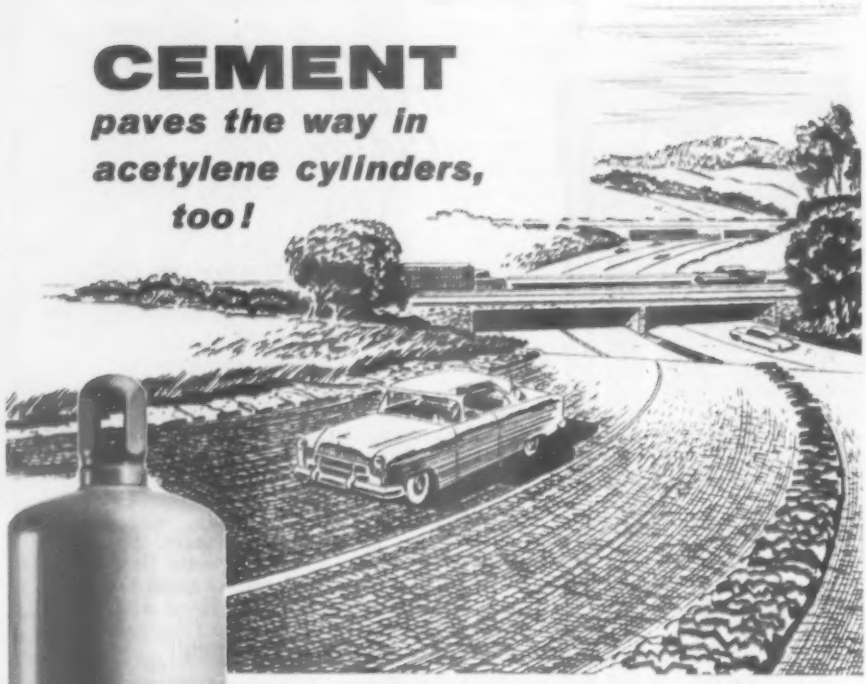

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Welding operator and helper worked together in making welds. While operator welds on side of 30-inch diameter pipe, helper cleans the other. Only chisels and brushes were used for cleaning operations.

permitted between passes in making 94.2 inches of weld. Each bead was properly cleaned by the helper, using chisels and brushes but not power tools.

External line-up clamps were used to align meeting edges to the 1/16-inch gas specification held. Line-up clamp was removed after 75% of the root pass was properly spaced and completed to hold the alignment.

No preheat was used, nor was any peening, chipping or stress relieving done.

Radiograph All Welds

All welds were completely radiographed, using radio-isotopes of cobalt. Tentative API standards were followed throughout.

Location and number of test specimens complied with API standards and included face bends, tensile tests, nick breaks and root bends. Two additional cross sections were taken at each location so that both macro etching and Rockwell B hardness tests could be made. This made a total of 24 test coupons per weld. Two operators, with two mill bevels, produced a total of 86 test coupons.

All specimens were laid out and gas cut from welded pipe nipples after each was properly steel stamped for identification as to type, bevel, operation and location in welded pipe nipples. Each specimen was given necessary machining.

Visual inspection was made of the machined bevels. They were found to be very exact and at lower limits of tolerances. Lands or flats

All welds were completely radiographed using radio-isotopes of cobalt. X-ray negatives were made and checked right at test site.

were same on all machined scarfs.

Maintain 1/16-Inch Opening

When assembled, 1/16-inch opening was maintained using the same gauge to check the spacing in the external lineup clamps.

Width of groove at outside surface of the assembled 30° bevel weld nipples was 7/16-inch, while that of 37½° bevel was 9/16-inch. After welding, this same ratio held: the 30° bevel weld was ½-inch wide, while the 37½° bevel weld was ⅝-inch wide.

A study of welding time showed total time consumed by the first operator in making the 30° mill bevel weld, was 56 minutes and 59 seconds compared with a total time of 76 minutes and 47 seconds for the 37½° mill bevel weld, a difference of 19.8 minutes.

The second operator consumed 58 minutes and 44 seconds in making the 30° weld. This compared with 74 minutes and 47 seconds in making the larger weld, a difference of 15.5 minutes.

An average of the two operators' welding time showed that 30.5% more time is required for 37½° bevel.

31.3% Electrode Savings

When amount of deposited electrode was compared, the first operator showed a savings of 33.9% on the smaller mill bevel. The second operator showed a savings of 28.8%. This is an average savings of 31.3%.

Weld beads on the outside of the 30° bevel were slightly more rounded, showing surface tension of the parent plate on the molten pool of weld metal was greater on the 30° bevel weld than on the 37½° weld.

The inside weld bead was slightly higher on the 30° bevel. This was due to the fact that operators had less trouble with molten weld metal. They did not have to hurry along as fast. The chilling effect of parent metal was greater with the 30° bevel.

Good Weld Appearance

Both welds presented an acceptable appearance on the outside, the

(Please turn to Page 70)

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smaller one being more regular on the inside. Neither undercutting nor flooding was observed on either type weld.

Reading of x-ray negatives indicated that both types of welds were highly acceptable according to API and other commercially accepted standards. Porosity and included slag was singularly low and well within accepted standards for such inclusions. Accumulated porosity in the 30° bevel was slightly less than that of the 37½° bevel. This was due to the greater tendency to burn through on the latter.

All sixteen tensile tests broke outside the parent pipe and all failures were back away from the weld about 1½ to 2-inches or better. There was no indication of failure having started in welds.

Burn-Through Causes Failure

In bend tests, one out of the eight root bend specimens on the 37½° bevel welds failed. This appeared to be at a burn-through spot. No additional tests were taken because all of the other three specimens of the same operator passed. To check preparation of the surface, one specimen of the other operator was left very rough. It passed satisfactorily. Surface imperfections proved to be more numerous and of greater magnitude in the 37½° bevel welds made by both operators.

All 16 test coupons passed standard nick break tests made with the temperature the same in all specimens. Because of the greater thickness through welds, fractures had a tendency to follow the fusion line of welds. There was no indication of lack of penetration.

Thirty-two macro etched specimens indicated very sound metal for both parent pipe and welds

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made in both bevel sizes by all operators.

Results of Hardness Tests

Rockwell-B hardness tests indicated there was no practical difference in the two bevels or in either operators or in any of the positions in the circumference of each weld. One might have predicted a pattern for the overhead and vertical welding. No such pattern could be established.

Chemical analysis showed the chemistry and amount of cold work on all pipe nipples was, for all purposes of this test, the same.

Micrographic study of the parent plate, weld affected area and weld metal revealed a satisfactory micro structure in all three areas on both the 30° and 37½° bevel welds. Because of the more repetitions on the heat cycles made in the seven beads deposited on the 37½° bevel over the 5 beads for the 30° bevel, the micro structure of the former is much coarser, as grains had more time to orient themselves and grow into larger grains or crystals. The finer grain microstructure of the 30° bevel weld would have more resistance to impact at lower temperatures, as well as greater resistance to fatigue or growth of a defect, such as fish eyes or incipient flaws.

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Automatic girth welders for field welding horizontal joints of cylindrical tanks and welding horizontal joints in numerous process vessels are available from Chicago Bridge & Iron Co. on a royalty basis. A number of United States and foreign patents covering the equipment and other aspects of automatic horizontal joint welding have been issued and other applications are pending.

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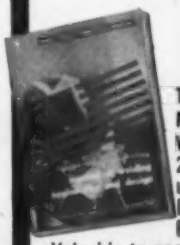

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Spot welding fabricates central heating box at Maloney Sheet Metal Works, Redwood, Calif., in only 30 seconds. Unit originally took five minutes of work time when made by soldering.

Spot Welding Speeds Production

MANUFACTURERS of sheet metal products and wire products can increase production, improve design and quality, and lower costs by using one of the most ancient, least spectacular and perhaps least understood of all welding techniques for joining metal. Known as spot welding it is now coming into widespread use throughout the Pacific Coast as a result of the development of practical, low cost equipment.

Of all the resistance welding techniques such as seam, butt, projection, or spot, the spot welding method has suffered from a strange lack of publicity. Very little has yet been written on the every day simple welding of steel and other materials in sheet metal with the comparatively inexpensive spot welder. Actually, many firms now using other joining methods can save considerable time and money by shifting to the spot welder.

How It Works

Resistance welding is a pressure welding process in which the heat required for fusion is obtained as a direct result of the resistance of the metal to the flow of electricity. Joining is accomplished by clamping two copper electrodes to two or more pieces of metal and then

Spot welding equipment requires little space and simple jigs and fixtures. Versatile welders shown here fabricate a variety of items, ranging from ash trays to light fixtures.

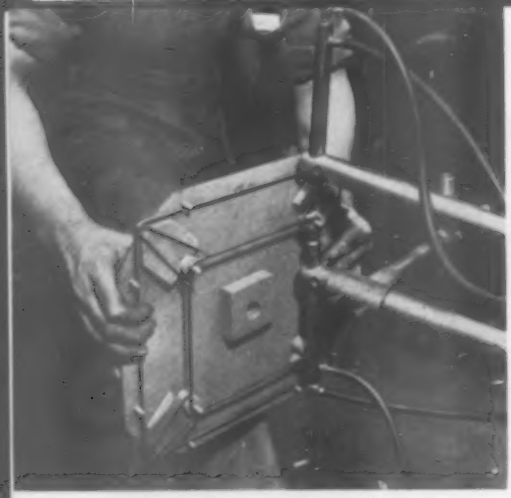
"Pacific Coast manufacturers are getting phenomenal production rates on a variety of products using practical, low-cost spot welding machines"

passing electricity through the clamped metal. Heat generated by the electricity passing through the pieces of metal, reduces that heated spot or area to a plastic condition. Additional clamping pressure is applied and this produces the fusion of the metals.

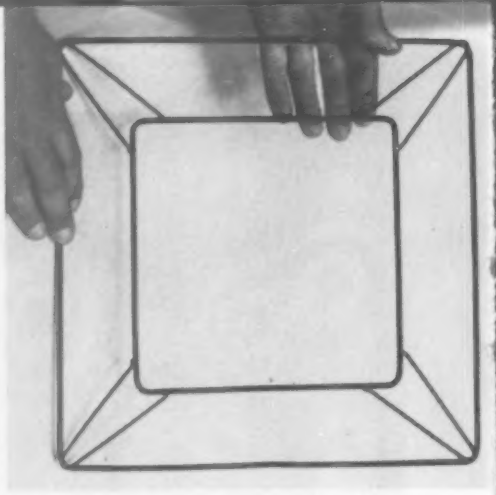
Spot welding as a technique to join metal was first noticed shortly after the discovery of electricity, but its first use to any appreciable extent came during World War I when spot welding commercially was expanded to a large variety of industrial uses. The process was adapted to mass production during the years between 1926 and 1931 and its development was stimulated considerably by the industrial requirements of World War II. The other welding processes, such as inert gas arc welding and flash welding, require more elaborate equipment and operator know-how, and in many instances do not provide the right formula for the job. Because of these reasons, Pacific Coast industrial firms have been shifting to the less expensive and more efficient technique of spot welding, whenever it can be applied.

Efficiency of Design

All spot welders operate on the



Using simple jig, Gross Wood Co., performs entire spot welding operation on this wire frame in less than one minute.



Total of 12 welds were made on the wire frame. Smooth surfaces are ready for painting; there is no need for grinding and cleaning.

same basic and well-known principles and all do essentially the same kind of work. The sole difference between brands of spot welders can be traced to efficiency of design. Spot welders range in price from as low as a hundred dollars to several thousand dollars, depending upon the size and application. For welding mild steel and wire, the average small metal working shop, using up to $\frac{1}{16}$" plate, can get practical value out of the type of spot welder costing under $1000. However, a small manual spot welder can be purchased for as little as $100.

Use in Sheet Metal Fabrication

The simplicity of the spot welding technique lends itself especially well to sheet metal fabrication, inasmuch as no outside material is added and there can be no distortion or warping of the metal. Any type of product which normally fits itself to spot welding can be produced very economically with this technique. Potential use of spot welding is increasing each year. Many new products, designed around the principle of spot welding, could not be manufactured competitively without the use of this processing technique. Many sheet metal and art metal shops have adopted the spot welder as one of their basic tools, and the list of products being turned out by this process is an almost endless one, and includes such well known items as radio and television cabinets, metal desks and chairs, file cabinets, waste baskets, kitchen utensils, grocery carts, bird cages, lamp shades, refrigerator racks.

The advantages of spot welding, as compared to other welding techniques, are speed, simplicity, smoothness of design, and economy of operation.

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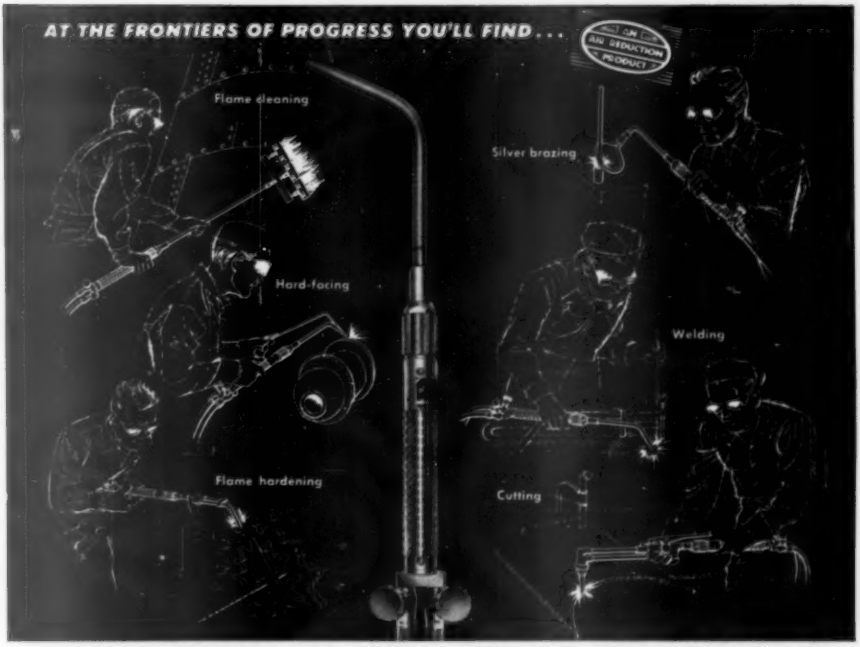

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insertion of rivets or screws is eliminated—and less time is required for setting up jobs. With riveting, one rivet would be required every half inch and would consume 20 minutes of time by a workman. Spot welding, would join the same two pieces with spot welds half an inch apart every 30 seconds.

Spot welding is used by Applied Electronics Company, Inc., to fabricate cover for a power supply component for radio telephone equipment.

A weld 12 inches long, having 12 spots can be done in less than one minute, whereas any other welding method would require more time to set up for welding.

Easy To Use

Simplicity is a major factor in the attractiveness of spot welding. In most such operations, no jigging is necessary to hold the work being welded. In those instances where jigging is required, it is extremely simple. The fusion by heat and pressure accomplished by spot welding makes the technique especially valuable in working with mild steel, galvanized sheets, mild steel wire and coated wires. Smoothness of design is achieved by virtue of the fact that there is

no weld to be ground off; no rivets or screw heads are present to mar the smooth surface.

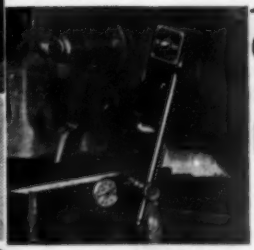
Key Point Is Welding Economy

The economy of spot welding should not be overlooked. Less man hours are required to handle the same job completed by a more laborious method. No inventory of fasteners or other such materials is needed. Spot welding equipment requires very little maintenance or repair and has unusually long life with low upkeep. The mechanical points of movement require only nominal care.

Spot Weld Various Items

One of the best illustrations of the diverse uses to which spot welding can be put is the operation of Gross Wood & Company, San Francisco manufacturers of a variety of specialty items ranging from ash trays to light fixtures. This firm has made 24 murals out of wire for bar decorations. The largest is 38 feet long and 5 feet wide—and every piece was joined together with spot welding!

Wood, who has been in business in San Francisco since the end of the war, explains that spot welding makes it possible for his firm to do work "that couldn't possibly be handled with any other type of welding process or machine." For example, he produces a special job, for a large brewery firm, involving frames made of wire and requiring 12 welds for joining. "By using spot welding," Wood pointed out, "we've been able to produce 480 frames in an 8 hour work shift, taking less than one minute per frame.—And we've had less than four per cent rejects."



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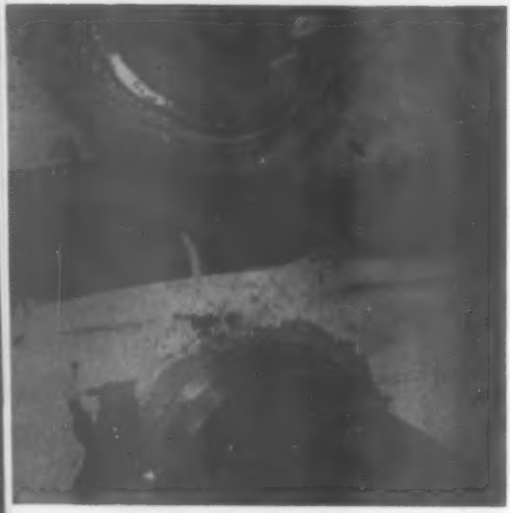


1 In joint fit-up, end of stub connection is cleaned, inserted into butt on shoulder in header opening. Note welding groove machined in header.

2 Preheat temperatures as much as 200 degrees below normal may be used.

New system produces consistently sound welds of high ductility—ready for X-ray examination. Reduced heating requirements save time and money.

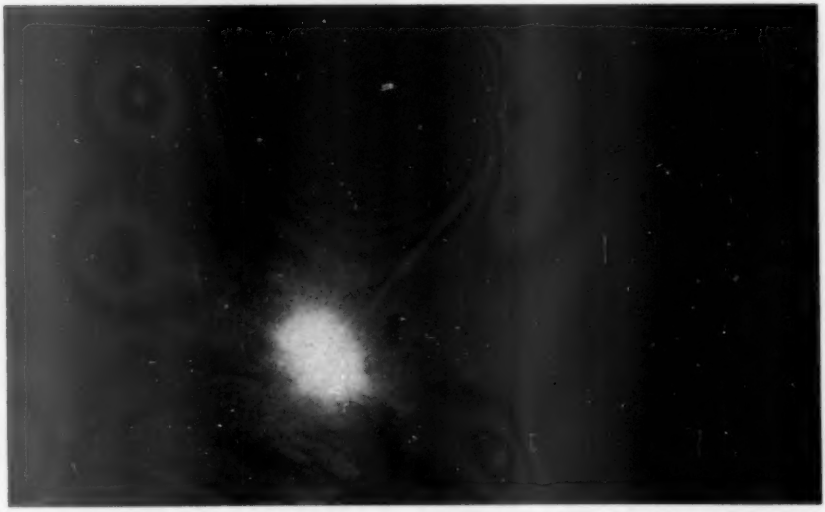
by LLOYD C. NESBITT*

New Method Solves

INVESTIGATION of a serious power plant failure some years ago disclosed the need for more dependable weldments of the chromium-molybdenum steels used in this critical high temperature, high pressure service. One of the leading manufacturers of power boilers and power piping, after a considerable amount of research, developed a system which has since been used in their own shops in fabrication and assembly of power equipment products.

As a result of insistent demand in the power industry for permission to use this welding procedure, originators finally yielded to pressure, and have released the system for commercial use.

Welding the chrome-moly steels



3 Electrode is held at a 90 degree angle to work. Short arc is recommended. Weld metal should be deposited with a weaving technique to slow down cooling of weld puddle.

Problems in Chrome Moly Welding

has always presented some difficulty due to their tendency to harden and become brittle while cooling down from welding temperatures. Although a considerable number of chrome-moly electrodes have been available for this work, none of the previous formulations has produced a deposit of sufficient ductility to prevent the type of hardening characteristic of the base metal. When using hydrogen bearing coatings, unless extremely high pre-heats were used, the inherent hardenability of the base metal, in conjunction with the hydrogen content of the arc zone, produced a tendency to "underbead cracking." While effects of hydrogen could be substantially eliminated by using lime-titania type electrodes, their high carbon content, coupled with an oxidizing slag, resulted in weld deposit of doubtful physical properties.

The new Croloy method is an arc welding system designed for reverse polarity, direct current welding in all positions. The system is based upon use of low hydrogen electrodes with carbon content held at .05% max. and with straight lime coatings. Classified under AWS and ASTM specifications as Type XX-15, these electrodes provide a weld metal deposit of controlled analysis and high ductility. This type of coating, in addition to controlling and limiting carbon in the weld metal, maintains ductility regardless of condition of preheat, post heat, in-

"welding chrome-moly steels has always been a problem because of their tendency to harden and become brittle while cooling down from welding temperatures"

terpass temperature or rate of cooling of the weld metal.

Recommended Current Ranges

Choosing the right diameter and proper amperage is as important as selecting the right basic type. Avoid the usual tendency to use the largest rod the work will support. Instead it is better to pick the highest current the work will bear and then choose the diameter electrode that will still operate at this current. Recommended amperages for various electrode sizes are:

$\frac{3}{32}$-inch, 80-100 amps; $\frac{1}{8}$-inch, 110-150 amps; $\frac{5}{32}$-inch, 150-190 amps; and $\frac{3}{16}$-inch, 190-220 amps.

Note that these current ranges are somewhat higher for these than for conventional electrodes.

Joint Preparation

Joints should be carefully fitted, paying particular attention to preparation of the welding groove. Since the lime coating produces a rather heavy slag volume, the root opening should be wide enough to manipulate the slag and insure good penetration. In those cases where no root opening is provided, it is recommended that the included angle be not less than 90 degrees. When a root opening of $\frac{1}{8}$ inch or more can be provided, the angle may be reduced to 60 degrees or less, depending on the width of the root opening.

4 Chipping hammer is used to clean welds between passes. If necessary, wire brushing can be done.

Cleaning Weld Area

The weld area must be carefully cleaned to remove all dirt, oil, etc. Since this system deposits fully killed steel, the accidental inclusion of any source of oxygen such as rust or scale may seriously interfere with quality of the deposit. It is preferable to weld on a joint fitted with a backing ring in order to protect the molten puddle from oxidation on the underside. However, small tubular joints have been welded successfully on an open root.

Less Preheating Required

Preheat requirements for a chrome-moly job will vary with the weld thickness and geometry of the weldment. There is no set rule, but remember that the heat affected zone of the base metal will harden to the same degree, regardless of the ductility of the weld deposit, so that some preheating is always necessary.

The Croloy system, however, permits welding at preheats from 100 to 200 degrees below tempera-

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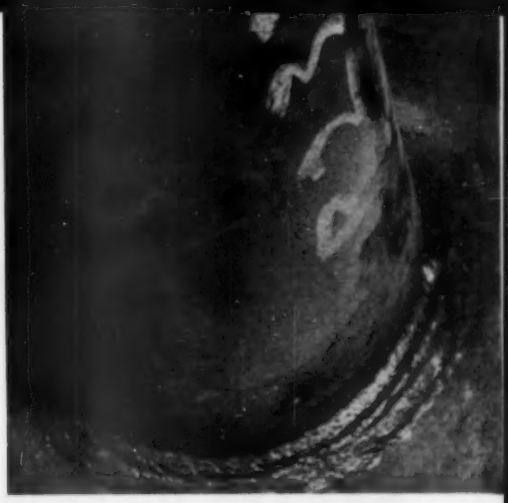
5 Appearance of weld is shown after completion of second pass. Note that welding groove has been filled.



6 Finished weld has fine ripples, is free from porosity and has excellent radiographic qualities.

tures commonly considered necessary for these steels. When welding steels in the lower ranges of chromium content—up to 2 chrome —½moly—300 F. will be sufficient heat for all but the heaviest sections. For the 2¼ chrome-1 moly and 5 chrome-½ moly compositions, preheat should employ higher temperatures and be more carefully applied, but even here more latitude is allowed than with other types of electrodes.

Welding Procedure

In order to attain the high quality weldments which this system is capable of producing, the operator must cooperate by observing a few simple precautions. The special techniques under this system are few in number but they *are* important.

The arc should be held very short in order to avoid the introduction of air, with resultant difficulties from oxidation of the weld puddle. Excessive tilting of the electrode will also cause trouble because this permits air to enter the arc zone. In general, the electrode should be held at an angle of 90 degrees to the work. This may at first seem difficult to accomplish in pipe welding, but a little practice is usually all that is necessary. A deviation of 5 to 10 degrees, moreover, will have no adverse effects.

Weave to Slow Down Cooling

To slow down cooling rate of the weld puddle, experience indicates that wherever possible weld metal should be deposited with a weaving technique. In order to avoid trapping slag in the deposit, the electrode should be manipulated so that the arc does not strike into solidified slag. Actually, the width of weave is limited only by the operator's ability to keep the slag molten across the crater area. The slag should be carefully cleaned from the surface of each bead before depositing the next bead in order to prevent inclusion of slag particles.

Post Heating

While post heating requirements vary with the application of the weldment, some relaxing of pro-

cedure is possible where permissible under Code Rules. When welding the 1.0% and 2.0% chromium steels, unless sections to be welded are extremely heavy, it is unnecessary to maintain preheat after welding and prior to stress relieving. In fact, unless applicable Codes require it many Croloy weldments may be safely placed in service without stress relieving.

Steels containing 2¼ chromium and up should always receive a post weld heat treatment. Temperatures of 1300-1400° F are usually considered good practice for stress relief on these materials.

Storage of Electrodes

Since electrodes used in this system are of the straight lime, low hydrogen type, their maximum usefulness can be realized only if coatings are perfectly dry. They should be protected from moisture absorption both in use and in storage. The moisture content is kept at an extremely low level during manufacture, and they are shipped in moisture proof cans. As long as the package remains unopened, they are adequately protected. As soon as the can has been opened, however, it is preferable to store the electrodes at a somewhat higher temperature. The heavy coating of the electrodes, and their low moisture level keep spatter losses low in all positions.

High Temperature Properties

Electrodes for the Croloy system are provided in four formulations, indicating the approximate percentage of chromium found in the weld metal deposit. Elevated temperature properties of weld metal deposits of each of these grades have been found equal or superior to those of the base metal of equivalent chemical analysis.

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Procedures recommended under the Croloy system enable operator to produce sound welds on chrome-moly steels at minimum time and expense. Weld beads exhibit fine contours, are free of porosity and suitable for work requiring radiographic examination.

For more information on this new process, write to The Editor, INDUSTRY & WELDING Magazine, 1240 Ontario St., Cleveland 13, Ohio, or Circle Number 200 on the enclosed Reader Service Card.

*The author is a field engineer with the Metal and Thermit Corporation.

INERT ARC CUTTING

(Continued from Page 46)

power supply. This should be at least 80 volts.

Investigation and experimentation have shown that best results are obtained when employing a mixture of argon and hydrogen. For machine cutting, the optimum mixture appears to be one containing 65 percent argon and 35 percent hydrogen. With this mixture a high arc voltage is developed. This arc voltage, however, can be readily obtained with a power supply having an open circuit voltage of 100 volts.

Gas Mixture for Manual Cutting

In the case of manual cutting, it has been determined that the optimum mixture is approximately 80 percent argon and 20 percent hydrogen. The lower hydrogen content is employed in manual cutting in order to provide a greater tolerance for variation in arc length than required for machine cutting. Further, even with the lower voltage at the 80-20 mixture, maximum cutting speeds can be obtained

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without sacrificing quality of the cut.

Linde, which expanded the use of aluminum for welded fabrication by development of its inert arc welding method, has now produced, in its inert arc cutting equipment, a new tool that could revolutionize the aluminum fabricating industry.

For more information on this new process, write to The Editor, INDUSTRY & WELDING Magazine, 1240 Ontario St., Cleveland 13, Ohio, or Circle Number 20 on the enclosed Reader Service Card.

ALL-WELDED CHAIN

(Continued from Page 50)

position to contact links.

At this point, a pneumatic cylinder takes over. When predetermined pressure (as measured by pressure switch) is reached, current is initiated and pneumatic system follows through, making the weld.

After weld is made, jaws open and links advance, bringing in new link for welding. As welded links move on, extruded flash is trimmed at subsequent station.

INDEXING TURNTABLES BUTT WELDERS SPOT WELDERS

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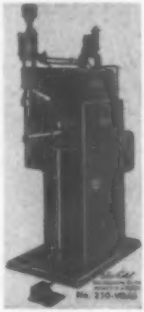

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MOLYBDENUM

(Continued from Page 59)

F) are used, generally in the form of foil.

Many brazing materials have been tried for high temperature structural applications.

A nickel-chromium-boron alloy (AMS 4775) is suitable for service applications up to 2000°F; it is satisfactory for hydrogen brazing but not for brazing in vacuum. On the other hand, silver-palladium and palladium-iron alloys have given good results in vacuum brazing, but are not recommended for hydrogen brazing.

A molybdenum-boron powder with a melting point of 3450°F has recently been developed and can be used for hydrogen brazing. This braze will not volatilize to any detectable extent at useful temperatures, whether in hydrogen or extreme vacuum.

Photographs and information courtesy of Climax Molybdenum Co., New York, N. Y.

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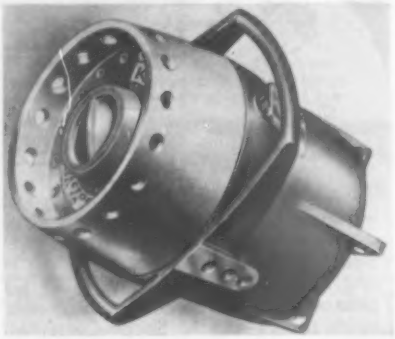
Portable Gamma Ray Projector

A new portable gamma ray projector for non-destructive testing has recently been placed on the market by The M. W. Kellogg Co. The exclusive sales agent is Metal & Thermit Corp. The gamma ray



projector is said to be extremely safe to operate, costs less than comparable radiographic equipment, needs no electricity, no control board, and requires no maintenance beyond replenishment of the small metal capsule, called a "source."

Projector can take a picture of 360 degrees, and exposure times are said to be very short.

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Resinoid Grinding Wheel Bond

In its new B-11 resinoid bond, Norton Company announces a step in the direction of greater uniformity of resinoid bonded grinding wheels. This new bond is said to insure a much more uniform structure than has been possible in resinoid wheels previously.

According to the manufacturer, the increased uniformity of spacing of abrasive grains throughout the wheel is reflected in all-round improved performance. Specifically, it is said to indicate more accurate and uniform work, improved surface finish, reduced diamond truing tool cost as well as lower unit grinding costs.

Wheels with the new bond are available in a wide range of hardness grades and sizes.

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Dye Penetrant Inspection

Ultrasonic vibration to accelerate penetrant inspection has been introduced by the Met-L-Chek Co. High speed vibration equipment, said to be compact,

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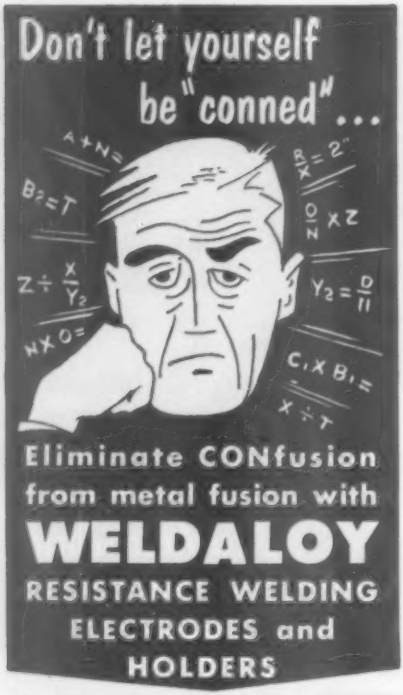
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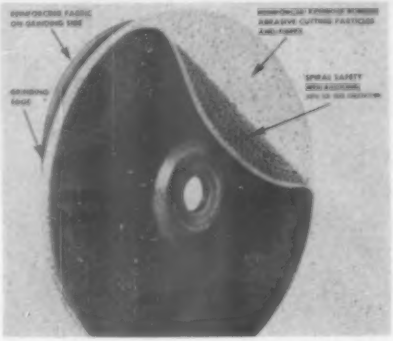

reinforced resinoid bonded abrasive wheel designed specifically for use on portable disc-type and right angle-type portable grinders. Wheels are made in depressed center or raised hub shape in 7-inch and 9-inch diameters by $\frac{1}{8}$ and $\frac{1}{4}$-inch thicknesses. Applications indicated for wheels include rough production grinding of welds, removal of flash and bead, cleaning up of rough ragged surfaces and edges and for all types of stainless steels.

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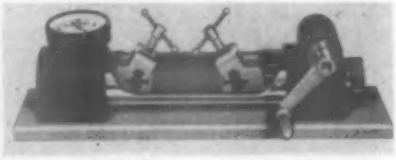

knob facilitates adjusting specimen jaws, and only a moderate pull on the crank is sufficient to apply maximum load. Results are easily read from the load gauge on top. It is light and compact, and should prove useful in the shop and field applications.

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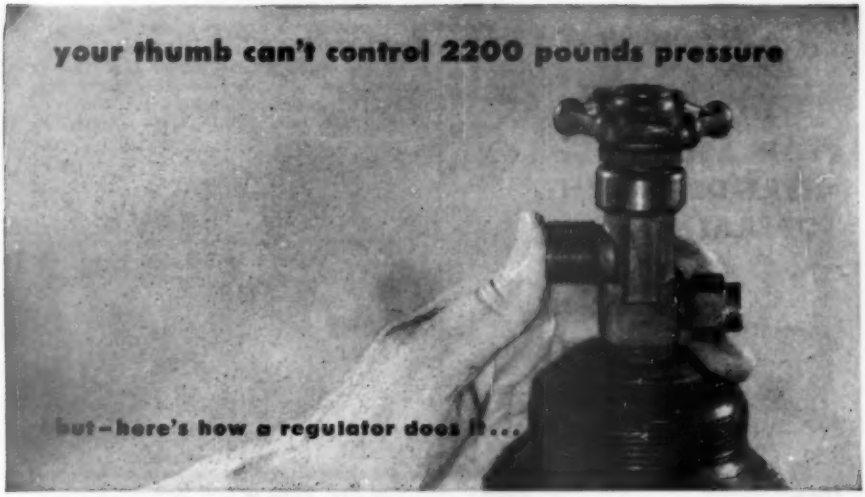

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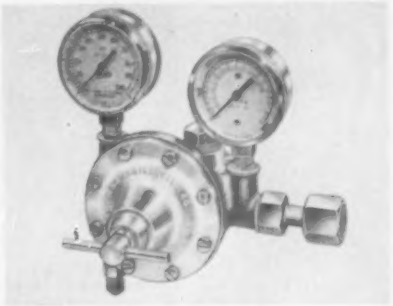

and uniform pressure is a must.

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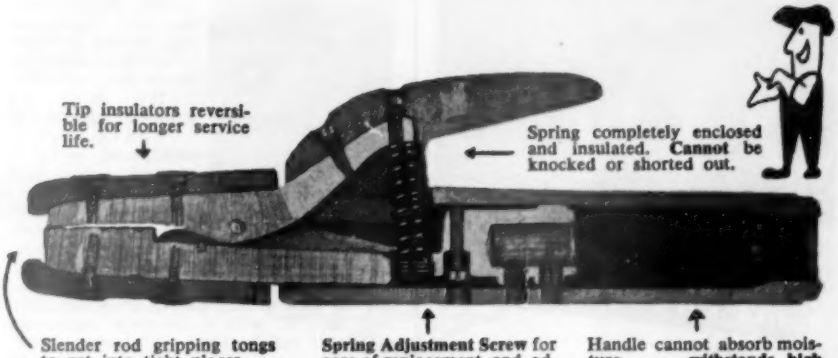
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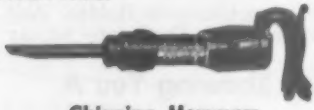

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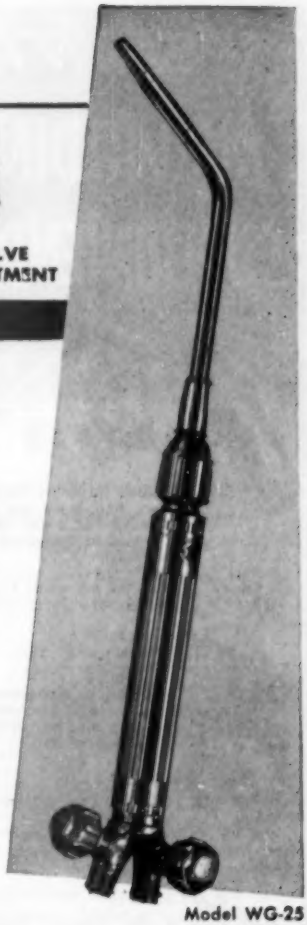

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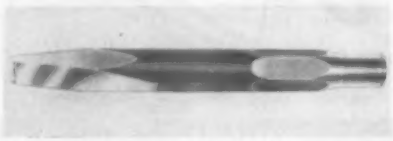
A newly designed pneumatic chisel shank that eliminates shank breakage and reduces accident hazards, is offered by the Delaware Tool Steel Corp. Featuring a greatly increased shank cross-section, and lacking sharp shoulders



where breakage normally occurs, the new shank is said to be as strong as the chisel body itself. Also, it is claimed that the new shank makes chipping operations safer because the chisel can be worn down to the nubbin without fear of shank breakage. As well, the new design is said to increase the efficiency of pneumatic chisels as the full power of the hammer is delivered to the cutting edge of the chisel.

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Continuous Seam Welding Tube Mills

Said to be capable of welding pipe or tubing 4" to 48" diameter, with metal thickness 1/16" to ½", continuous seam welding tube mills have been added to the Pandjiris Weldment Company's line of production welding equipment. The manufacturer states that, according to the method used, the tightly butted edges of the seam move in a straight line without twisting or turning and with great automatic accuracy. The work can be fed into the machine one piece against the other with no loss of time in clamping or in stopping or starting the arc between pieces, resulting in a continuous flow through the mill.

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Aluminum Cleaner-Deoxidizer For Resistance Welding

Stronger, more uniform resistance welds on aluminum and aluminum-alloys at a lower cost are claimed possible by using a new process formula cleaner-deoxidizer-inhibitor developed by The Diversey Corporation. It is indicated that the solution will produce water-break-free surfaces removing greases, ink and shop dirt. Retains solution strength for long periods, and has no toxic fumes, the manufacturer tells us.

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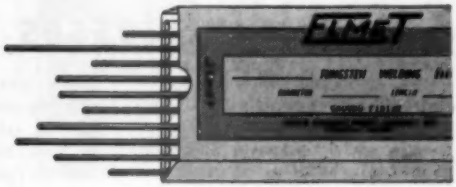

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A lightweight, retractable sound barrier curtain has been developed by Bemis Bro. Bag Co. Made of a flame-resistant and sound-reflecting material,

a specially treated and coated burlap, TransWall can be installed anywhere in plants to isolate machine and production noise and potential fire hazards. Easily adjustable, curtains consist of 7-inch panel folds, chain-spaced to prevent complete extension and are supported by steel top plates that operate on nylon wheels in an enclosed track. They are available in several colors.

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Fire-Extinguishing Fluid

A revolutionary new fire-stopping fluid called CM-7 (azeotropic chlormethanes) is used in automatic and manual fire extinguishers marketed by Red Comet, Inc. New chemical is said to produce more vapor than carbon tetrachloride and has a lower freezing point. It is said to penetrate deeply into burning embers of wood and textiles and leave a residual fog that guards against re-ignition. Phosgene gas does not result from application of CM-7 to a fire and carbon monoxide is inhibited when either vapor or fluid comes into contact with fire.

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New Grinding Wheel

From the other side of the water, namely, Austria, comes word of a new grinding wheel. Manufactured by Tyrolit-Schleifmittelwerke, it has been introduced in this country by B. Franklin Soffe & Associates. Because of its nylon reinforcing and special bonding, the wheel is said to have a very high efficiency, long life, and is also claimed to be practically unbreakable. Wheels are recommended for deburring welds, cleaning castings, grinding sheet metal, bevelling metal sections, etc., and come in a variety of standard wheel sizes and grades of hardness.

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Cut welding losses due to moist rods

Your cheapest insurance against wasteful defective welds is DryRod. This oven protects low-hydrogen, austinetic, and other special alloy electrodes, as well as the new iron powder contact rods, against moisture.

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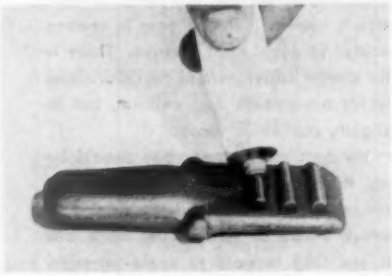

able in tubes or jars. Using gas flame, it can be applied to metal of less than ¼-in. thickness, and with proper heating any thickness of metal can be hardfaced. The paste is said to be of value in manufacture and maintenance of farm tools, earth-moving equipment and general industrial use.

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Fabricated Welding Wire for Hard Facing

Development of a new fabricated welding wire has been announced by the Drawalloy Corporation. Called Wear-O-Matic, the new fabricated wire is specifically for automatic and semi-automatic hard facing applications. It is said to be the first of its kind on the market.

Wear-O-Matic is described as a dense, controlled-diameter wire with uniform compactness for uniform chemistry and hardness. According to officials of Drawalloy Corp., the fabricated wire is precision drawn to provide a smooth feed with any automatic head without use of special feed rolls or contact tubes. As a final step in the production of Wear-O-Matic, it is electroplated with copper. This, the company indicates, is done to prevent surface rust and to insure positive electrical contact.

Circle No. 17 on Reader Service Card.

Speed Horizontal Fillet Welding with Low Hydrogen Electrodes

AN increase in horizontal fillet welding production through the use of low hydrogen type MIL-180 electrodes (MIL - E - 986A Ships) has been reported by the Puget Sound Naval Shipyard. The increase was due entirely to the new electrode type rather than to increased operator efficiency.

This was brought to the attention of the shipyard when welding supervisors compiled the accompanying table, which shows a comparison of the various production rates produced in horizontal fillet welding procedures under average shop conditions.

Bureau of Ships Instruction 9110.1 of September, 1952, states that a $\frac{3}{16}$-inch size fillet weld made with a MIL-180 low hydrogen type electrode is equivalent in efficiency to a ¼-inch size fillet weld made with a MIL-6010 electrode.

Similar efficiences exist among other weld sizes.

ABOUT LOW HYDROGEN ELECTRODES

Originally intended for welding armor plate as a substitute for critically short stainless steel types, low hydrogen electrodes can be used for a wide variety of applications on high carbon steels, high sulphur (free machining) steels, malleable iron and a large variety of alloy steels. Underbead cracking has been virtually eliminated by these electrodes. A minimum of preheating is required.

Available for use with both A-C (E-XX16) and D-C (E-XX15) welders, these electrodes have exceptionally high ductility at higher than usual strength.

Because coatings on low hydrogen electrodes are heavier, they require closer control of arc length and molten metal manipulation.

Properly used, low hydrogen electrodes have a soft, steady arc. Penetration is only slight to medium. Control of slag and molten metal is easy at high amperage, but difficult if amperage is too low. Slag is easy to remove except in deep, tight grooves. There is no spatter under normal conditions and welds are smooth and uniform, flat to slightly convex in contour.

For best results amperage should be on the high side of the suggested range. Arc should be kept short and struck ahead of start, going back into it and then forward to avoid porosity.

When weaving techniques are used, pause at each side wall to wash up slag.

PUGET SOUND NAVAL SHIPYARD STANDARD

FILLET WELDING PROCEDURE, HORIZONTAL (FLAT) POSITION (METAL ARC)

Weld Size	Electrode Type	Rod Dia.	Inches Of Weld Per Rod	Seconds To Melt One Rod	Seconds To Weld One Foot	Efficiency	No of Passes	Lb of Rod Per Foot of Weld	No. of Rods Per lb.	Length of Rod	Feet Per 8 Hrs. Continuous Welding
1/8	180 LH	1/8	14	75	65	100%	1	.07	13.7	14"	450'
	E6010	1/8	10	85	102	63%	1	.07	17.6	14"	283'
3/16	180 LH	3/16	16.5	85	62	100%	1	.14	6.6	14"	465'
	E6010	5/32	9	87	116	54%	1	.14	11.7	14"	250'
1/4	180 LH	7/32	21.5	130	73	100%	1	.23	4	18"	398'
	180 LH	3/16	9.5	86	109	67%	1	.23	6.6	14"	266'
	E6010	7/32	15.5	148	115	63%	1	.24	4.8	18"	252'
	E6010	3/16	7	92	157	46%	1	.24	8.3	14"	183'
5/16	180 LH	7/32	12.5	118	113	100%	1	.32	4	18"	254'
	180 LH	3/16	6.5	87	160	71%	1	.32	6.6	14"	180'
	E6010	1/4	12	138	138	80%	1	.33	3.6	18"	204'
	E6010	7/32	9.7	142	176	65%	1	.33	4.8	18"	164'
	E6010	3/16	5	97	232	48%	1	.33	8.3	14"	123'
3/8	180 LH	1/4*	16	1st pass 130	152	100%	2	.52	2.9	18"	190'
			29	2nd pass 130							
	180 LH	7/32	15	1st pass 132	170	90%	2	.52	4	18"	170'
			25	2nd pass 132							
	180 LH	3/16	9	1st pass 83	291	52%	3	.52	6.6	14"	99'
			13	2nd pass 83							
			9.5	3rd pass 83							
	E6010	1/4	19	1st pass 147	180	84%	2	.52	3.6	18"	160'
			20	2nd pass 147							
	E6010	7/32	12	1st pass 98	204	75%	2	.52	4.8	18"	141'
			11	2nd pass 98							
	E6010	3/16	6.7	1st pass 95	385	39%	3	.52	8.3	14"	75'
			12	2nd pass 95							
			8.5	3rd pass 95							
1/2	180 LH	1/4			339	100%	4	.87	2.9	18"	85'
	E6010	1/4			410	83%	4	.87	3.6	18"	70'
5/8	180 LH	1/4			460	100%	5	1.32	2.9	18"	63'
	E6010	1/4			536	85%	5	1.32	3.6	18"	54'

*Use 1/4" dia. electrodes when welding equipment is capable of handling 310 amps.

Slow, uniform heating is required to prevent distortion of thin members. Operator uses soft, preheating-type flame, moving torch continuously to prevent local overheating. Wire in operator's left hand keeps alloy rings seated against cover. Fixture rotates on turntable.

Silver Braze Unequal Sections of

by **NORMAN S. STRANDWITZ**

AT first glance making the five joints in the assembly shown in Fig. 1 would appear quite simple. Yet few assembly operations present the variety of problems encountered in joining this stainless steel sub-assembly. Nevertheless, the nature of these problems, and how they were solved, should be of interest because techniques developed can be applied in many other production brazing situations.

The assembly described is part of a soda fountain syrup pump, manufactured by Bastian-Blessing Co., Chicago, which is assembled from four components: a rectangular cover (to which a plunger housing has previously been crimped); a syrup tube; a supporting rod; and a circular cup cover. In joining these components, a number of interesting brazing techniques were developed by Joseph W. Skurka, superintendent at Bastian-Blessing.

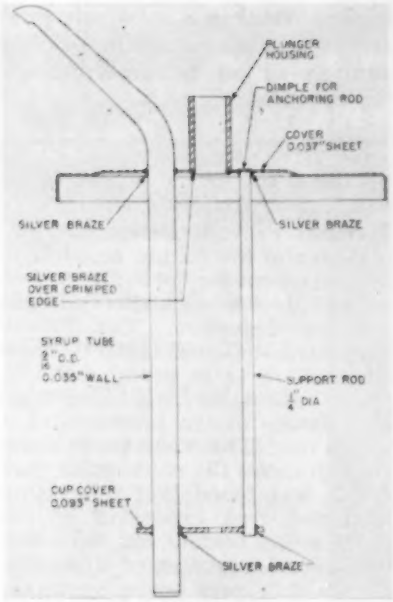

FIGURE 1. Five silver brazed joints are made on this frame assembly for a syrup pump. Note widely varying gages of major stainless steel components.

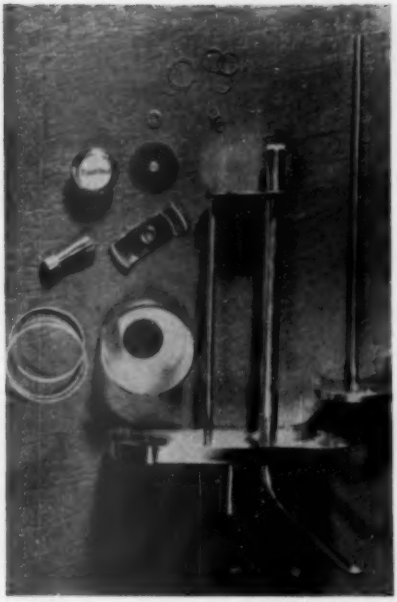

FIGURE 2. Shows disassembled syrup pump and several other parts which are joined by silver brazing.

Stainless Steel

How Problems Were Solved

Because thickness of the pieces vary widely, careful heating methods must be used to avoid distorting thinner members. For sanitary service, all joints must be completely sealed, crevasse-free and filleted at both surfaces to prevent entrapment of syrup droplets. Also, because stainless steel is a relatively poor conductor, care must be taken to prevent local overheating during joining, otherwise an extremely tough oxide forms which necessitates excessive finishing operations.

These stringent requirements were met by making the joints by low temperature brazing, using a readily available silver brazing alloy, thorough fluxing, and careful hand torch methods. The techniques employed demonstrate how an understanding of the action of heated metals can be applied to solve a variety of tricky heating and joining problems.

These are the material specifications for the four major components: (1) rectangular cover: .037-in. thick, type 302 stainless steel; (2) syrup tube: 9/16-in. OD, .035-in. wall, type 304 stainless steel;

"because stainless steel is a relatively poor conductor, care must be taken to prevent local overheating during brazing operations; otherwise formation of an extremely tough oxide necessitates excessive finishing operations"

(3) support rod: ¼-in. diameter, type 303 stainless steel and (4) cup cover: .093-in. thick, type 302 stainless steel.

Brazing Procedure Used

The syrup tube is brazed to the two cover pieces by means of pierced joints; the support rod is brazed at its lower end by a pierced joint, and by a butt joint at the upper end. Also, the crimped edge of the plunger housing, which protrudes through the cover, must be covered with a uniform fillet of alloy.

Techniques for making these joints were developed after a number of heating methods were tried. A controlled atmosphere furnace, a molten salt bath, and several other methods were experimented with, but none of them were able to produce, on a consistent basis, joints that had uniform, continuous fillets.

Finally. Bastian-Blassing adopted the technique of silver alloy brazing these joints with preplaced alloy rings, using hand torch heating. The firm makes its own rings by coiling the alloy wire on mandrels of the proper diameter and cutting with side-cutters. Three different wire sizes are used for the various joints: .025, .031 and .062-in.

A typical production station operator assembles the two covers supporting the rod and syrup tube, and the rings of brazing alloy on fixture preparatory to brazing. Previously all parts have been thoroughly degreased in trichloroethylene to remove any residual oil that might interfere with complete wetting of the brazing alloy to the joint surfaces.

Fixtures Prevent Distortion

Design of the fixture accounts to a large extent for the ability to join various thicknesses of steel without creating distortion. The fixture supports but does not grip the tube and rod, so as to permit them to "float" during brazing. The original fixture design incorporated a clamp over both these parts about an inch above the rectangular cover. It was found that this clamp restricted free expansion of the parts when heated and caused a considerable amount of distortion on the thin gage cover by transmission of resulting stresses.

The assembly is first fluxed and then brazed as it rotates on a 7-in. turntable. Though the joints are confined to a relatively small area, all surfaces of the cover, as well as most of the tube, rod and cup cover are liberally fluxed. Flux is used not only to help wet the joint surfaces but also as a protective coating for the surrounding metal to inhibit formation of oxides during heating. Though this is not an economical use of flux, it pays off by saving a laborious finishing process to remove oxide coating.

Use Multiple Jet Tip

After fluxing, the operator heats the work as it rotates, using an oxy-acetylene hand torch. A multiple jet tip is used to produce a soft pre-heating type flame. This is to avoid the possibility of overheating the metal and exhausting the protective flux too rapidly. A slightly reducing flame, (about a 2:1 ratio of acetylene to oxygen),

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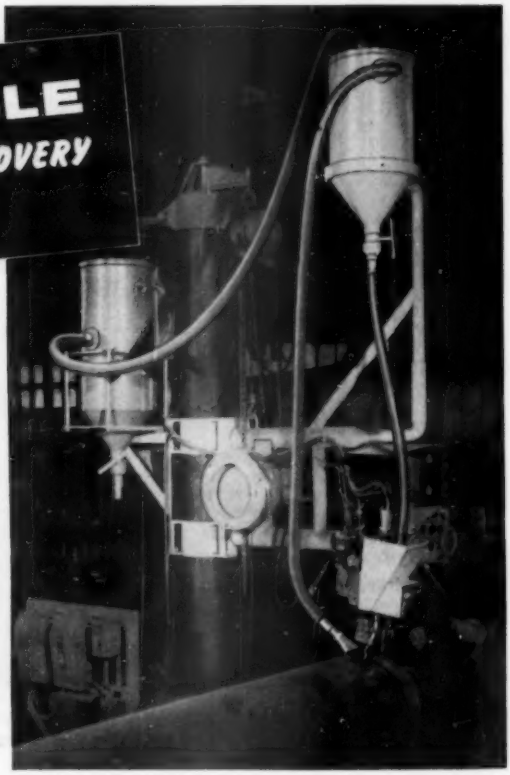

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* Actual photo of refrigerator plant production line where 11 joints are brazed on one assembly with less than 1% rejected under Underwriter's pressure test of 1500 lbs. per sq. in.

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Thorough fluxing is necessary for brazing stainless steel parts. Flux helps alloy wet joint surface and provides protective coating which inhibits oxidation of parts exposed to torch flame.

is used to inhibit oxide formation.

Operator's skill, plus steady rotation (15 rpm) of the turntable, are the keys to providing the even distribution of heat which is essential on this assembly.

First joints made are the three on the rectangular cover. As the work rotates the operator plays the long, bushy flame in a constant up-and-down motion for a short distance along the rod and tube. Because of the greater mass of the rod and tube, these must receive more heat, compared with the thin members, to bring all parts up to brazing temperature at the same rate. Continuous playing of the flame is necessary also because stainless steel is a relatively poor conductor. If the flame were concentrated at the joint area only, the heat could not flow away fast enough, and the cover would both warp and oxidize excessively. After the heavier parts are heated, the operator plays the flame on the cover, bringing it up to temperature as evenly as possible, and immediately correcting with additional heat any spots that begin to distort. The procedure is to heat the assembly to a point where the flux has a glassy liquid appearance. Then the first joint is heated to a red heat to melt the silver alloy ring in place. The remaining two joints on the cover are brazed successively in the same manner. After these joints are made, the same procedure is repeated to make the two on the cup cover.

Techniques For Flawless Fillets

Bastian-Blessing requires definite and flawless fillets on all joints for sanitation reasons, (fillets do not materially increase the strength of a joint). Torch handling techniques used to obtain these fillets on *both* sides of the pierced joints depends on two very useful char-

acteristics of silver brazing alloys. First, molten alloy spreads very easily on a well-fluxed surface; second, the alloy is attracted to areas of greatest heat. Thus in order to get the required full fillet on both ends of the pierced joints, the operator heats the upper and lower surfaces of the cover equally. When the alloy ring melts, part of it is immediately sucked into the aperture to form not only a solid joint, but also fillets at both edges. The amount of alloy used in excess of the amount needed to fill the volume of the joint determines the size of the fillets.

In addition to the five joints on the tube-rod-and-cover assembly, several other components are silver brazed. Referring to Fig. 2, which shows a complete syrup pump, note the rod attached to the flanged disc at left. This unit, which is the piston rod and head, is assembled by threading the rod into the head and then silver brazing an alloy ring over the threaded joint. The braze seals the joint, prevents seepage of syrup into the threads, and at the same time makes for a stronger assembly. The valve disc, next to

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the flavor cap, is also assembled with the aid of silver alloy brazing. The stud, at the center of the disc, is fastened in place by crimping. Brazing alloy is used to seal the joint without crevasses or cavities.

Air Cool and Quench

After brazing is completed, assemblies are allowed to air cool for a few seconds and are then quenched and allowed to soak in cold running water. This rapid cooling causes the spent flux to flake off almost on contact and the balance is soaked off. The assemblies are then dipped for 2-3 minutes in a molten salt bath which converts any oxides on the steel to a more soluble form.

Depending on production requirements, from one to three brazing stations will be operated. The average operating cycle, including fixturing, fluxing, brazing and quenching, is about 9 minutes per assembly. The set-up produces assemblies of consistently high quality which heretofore could not be obtained with any other joining technique.

Photos and data through courtesy of Handy & Harman Co. Author is with National Cylinder Gas Co.

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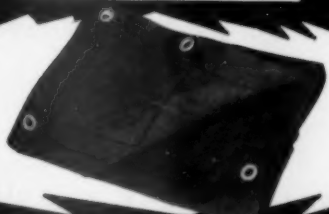

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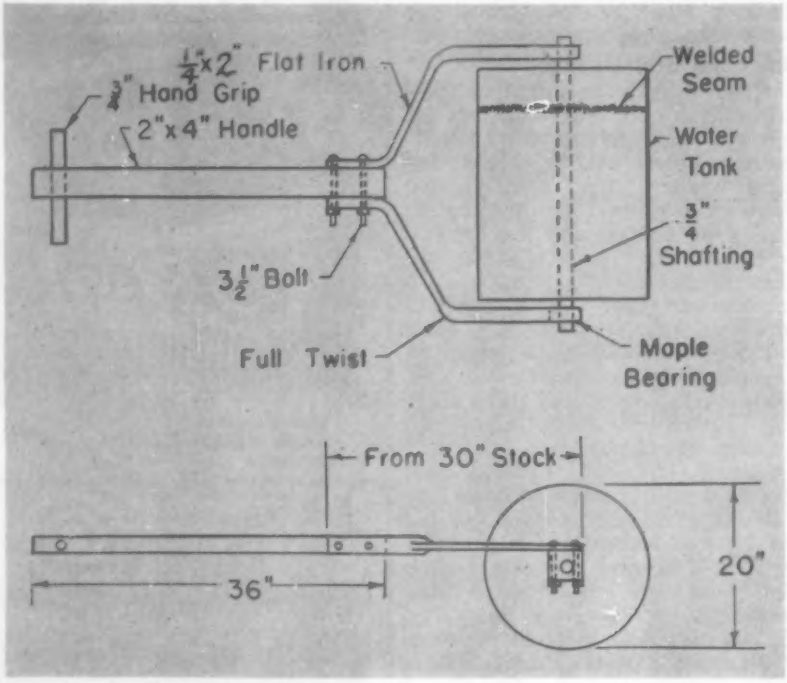

Welded Water-weighted Lawn Roller

THIS lawn roller was made from a 38-inch section, cut from a galvanized hot-water tank and joined by a mild steel all-purpose electrode. It was designed and built by Lee Hampe, a student of vocational agriculture in Jersey Shore, Pennsylvania, High School.

A plug fitting was cut from the lower end of the old tank. This was welded in a hole cut in the roller to serve as a water-filler opening.

The ends were drilled to receive a ¾-inch shaft which was welded to the tank, thus making water-tight connections.

Hardwood bearings, which had been cut and soaked in oil, were fitted to the ends of the shaft and attached to the handle of the roller.

Adapted from "Projects in Metal," published by James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio.

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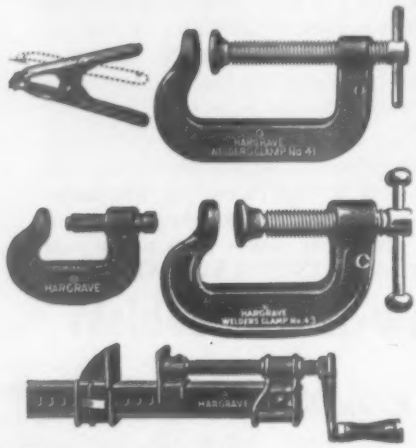

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- CHIP OFF

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NEWS

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Stulz-Sickles Holds Three Day Symposium

Stulz-Sickles Company, Newark, N. J., again held their three day symposium on reclamation welding. Their complete force of sales and administrative personnel attended the meetings held at Skytop Club, Skytop, Penna.

The three day session was presided over by Burt H. Payne, chairman of the board. Speakers included Roderick K. Chapin, president and general manager, and Robert Bramley, vice president and sales manager.

Unique Turntable Appoints Distributor

Charles S. Freeman Company of Buffalo, N. Y., has been appointed a distributor for Unique Turntable & Equipment Corp. in the greater portion of New York State and the Northwestern section of Pennsylvania. Unique manufactures a complete line of positioning equipment and turning rolls.

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MONROVIA, CALIFORNIA

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Modern Names Fausek Board Chairman

At a recent board of directors meeting Modern Engineering Co., St. Louis, Missouri, named A. J. Fausek as Chairman of the Board. Fausek was formerly President, a position he held for many years. Other officers include I. F. Fausek, president; Al. V. Fausek, vice president in charge of sales; Willis L. Reedy, vice president in charge of production, and I. F. Fausek, Jr., secretary.

Announce New Thor Pittsburgh Manager

Harry L. Artinger, a Thor industrial service engineer in the Pittsburgh, Penna., area for the past 10 years has been named Pittsburgh branch manager of Thor Power Tool Co., Aurora, Illinois, it was announced by J. A. Hill, Thor vice president and sales manager. Mr. Artinger will be in charge of all Thor sales and service activities in western half of Pennsylvania, southeastern Ohio and West Virginia.

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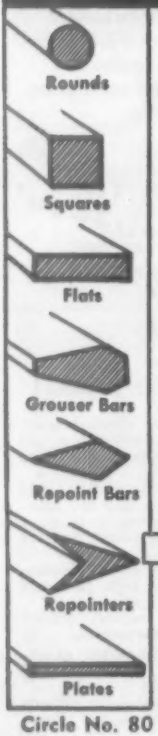

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SpraRod Corporation Moves to Larger Quarters

A move to new and larger quarters at 8001 Carnegie Avenue, Cleveland 3, Ohio, has been announced by Henry S. Rondeau of SpraRod Corporation. The firm manufactures a complete line of straight metallizing rods with patent-applied-for "quick link" threaded connection.

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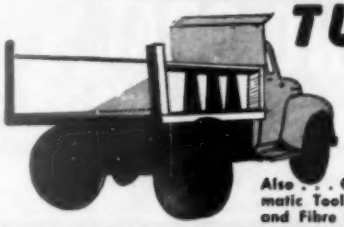

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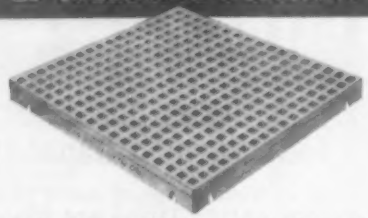

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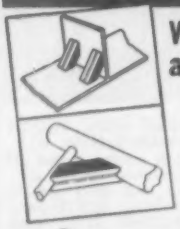

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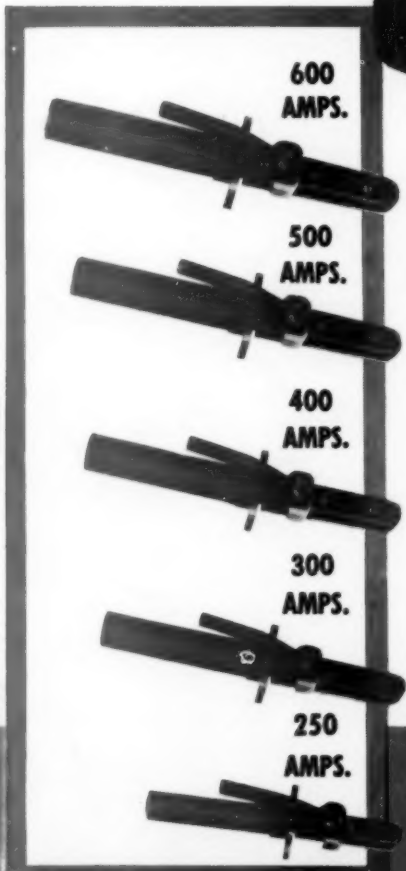

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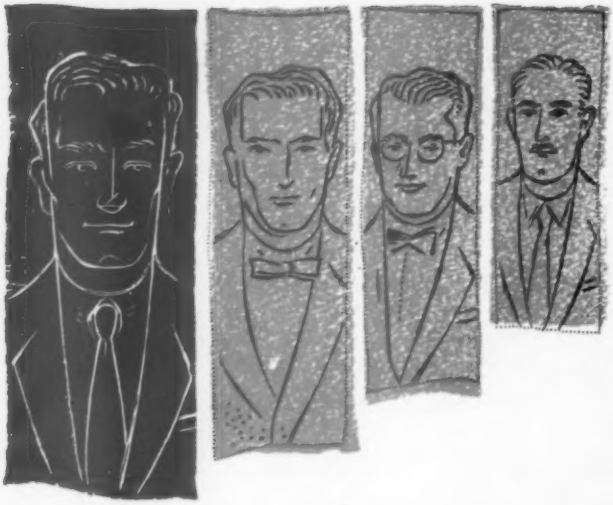

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